Railway Mechanical Engineer

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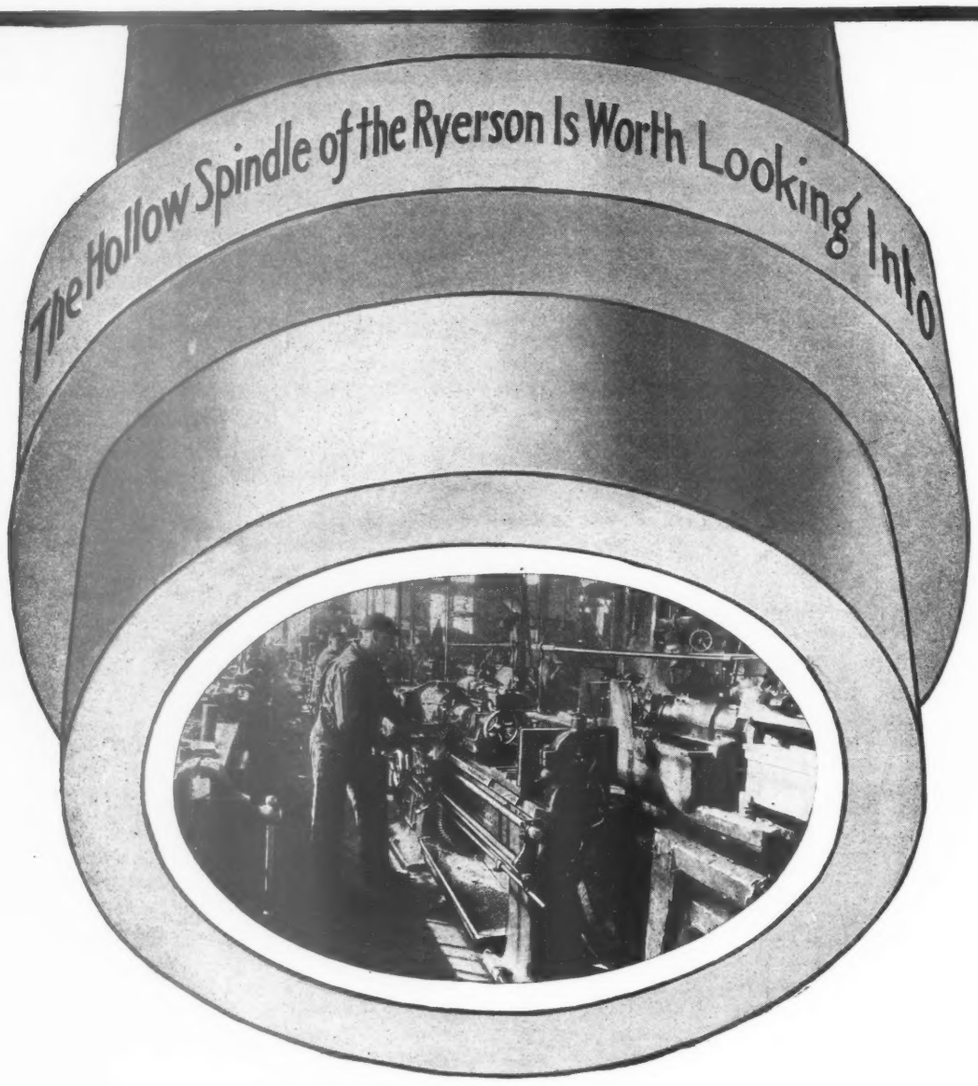

Mechanics Fight For—Ryerson Lathes

THIS photograph shows a typical railroad shop on an Eastern Line. One of the features that makes this shop typical of railroads is the Ryerson-Conradson Engine Lathe which is used for turning wrist pins and link motion parts for locomotives. You'll find R-C Lathes in most of the railroad shops; in fact, on a Western Line a mechanic insisted upon running the R-C Lathe that had just been installed there, and he put forth his claim of seniority as a reason why *he* should run the R-C. The qualities in a R-C Lathe that make the workmen fight for a chance to run it are the very reasons why you should look into this lathe.

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Write for Bulletin 1301

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In adjusting the cylinder lubricator feeds, how many enginemen count the drops of oil for a full minute? Instead the drops are counted for 15 or 30 sec. with the result, that owing to slight variations in the viscosity, either too much oil or not enough is fed to the cylinders. In the case of the former condition, an excess of oil enters the cylinders which eventually forms a heavy carbon residue that builds up behind the packing rings and eventually causes the rings to seize in the ring grooves and become inoperative, resulting in a great loss of power. Furthermore, the oil is wasted at the beginning of the run with the result that little or no oil is available for the latter part of the run. In the case of not enough oil, the cylinder and valve chamber walls are cut or scored which causes a loss of power to say nothing of the increase in maintenance costs. The attention of the enginemen might well be called to the fact that there are 60 seconds in a minute. To oil the driving rods, truck boxes, valve motion parts, etc., the engineman is supplied with a certain amount of engine oil. That it is not all used for this purpose is evident from the stream of oil on motion work and ground by which the path of some enginemen may be traced around their locomotives. This practice is not only an avoidable waste but defeats the ends for which the oil is intended and thus is conducive to increased friction which requires more fuel and more maintenance. These factors may seem unimportant but they are among the many little things which, added up, make the total a good or a poor job of railroading.

Carelessness in locomotive lubrication

In an address before the January meeting of the New England Railroad Club, W. J. Cunningham, professor of transportation, Graduate School of Business Administration, Harvard University, gave a highly enlightening exposition of the way in which railway operating efficiency is reflected by the figures for gross ton-miles per train hour. These figures, containing as they do both train load and time factors, primarily measure the efficiency of train crews, dispatchers, operators, yardmasters and others having to do with train service. They also reflect, however, the efficiency of practically the entire railroad machine and are vitally affected by the condition of car and locomotive equipment, for example. The mechanical department has an important part to play in gross ton-miles per train hour performance and can perform this part only by keeping each class of car in good condition for handling the commodity for which it was designed and furnishing motive power adequate in amount and condition to handle trains over the road with the minimum interruption of service due to failures or other causes.

Mechanical efficiency in operating index

A railroad, referred to in Professor Cunningham's paper, was able to make a marked improvement (32.5 per cent in 12 months) in gross ton-miles per train hour performance by purchasing new locomotives, making enginehouse improvements, rearranging yard tracks and sidings, and in particular by an intensive campaign to enlist the sympathy and support of the employees in an improved showing for their road. Charts were broadcasted weekly giving the performance as compared to the same week in the preceding year and the goal was gradually raised from 11,000 to 12,000 and then 13,000 gross ton-miles per train hour. The results of this campaign were plainly evident not only in improved operation, but reduced mechanical department costs. While freight locomotive and train miles in a given period decreased about 11 per cent over the same period in the preceding year, the number of cars per train increased 16.2 per cent; train speeds, 14.9 miles per hour; and car miles per car day, 30.5 per cent. On a thousand gross ton-miles basis, fuel consumption decreased 26.5 per cent, locomotive repairs, 28.7 per cent, locomotive supplies other than fuel, 10 per cent, and enginehouse expenses, 44.7 per cent. In other words, the mechanical men on this road by lending their assistance to the achievement of an operating goal made a splendid showing for themselves.

The value of keeping a single objective constantly in view was demonstrated in the case mentioned above which proved that while railroad mechanical departments are primarily engaged in maintenance and conditioning work, their efforts have a vital influence on railroad operation as a whole and on performance records often thought of as entirely operating in character. The sooner mechanical department officers realize these facts and broaden their interest in and knowledge of operating matters, the sooner will they be adequately represented among the ranks of higher railroad executive officers.

The development of foremen's clubs and training classes in the mechanical departments of the railroads has received a remarkable impetus this season. Many different schemes are being tried, extending all the way from classes in foremanship and leadership under the general direction of the extension departments of state universities, to supervisors' clubs with various sorts of programs. There is always, of course, a certain amount of help and inspiration by bringing in someone from the outside who has had a special opportunity of studying or experimenting with foremanship, salesmanship or management problems. On the other hand, the club members get out of the meetings largely in proportion to the extent to which they contribute to or take part in them. Giving expression to one's ideas helps to stimulate thinking and to crystallize ideas.

Making foremen's clubs more effective

The great difficulty is to find leaders who have the

ability or experience to conduct discussions in such a way that the club members will participate freely. We are constantly being asked for suggestions as to where or how group or discussion leaders can be found or developed. As a matter of fact, the successful conducting of such discussions is something of an art. It requires a man first of all with the right sort of personality and then some special training or experience. Fortunately this need has been recognized by a number of those who have been particularly interested in promoting foremanship training, and last summer several conferences were set up under different auspices to give prospective conference leaders an intensive training.

The foremanship training class held under the direction of the Y. M. C. A. at Albany and including foremen and supervisors from the Delaware & Hudson and the New York Central, as well as from the industries, sent three men last summer to attend one of these conferences for training discussion leaders, which was held under the auspices of the Industrial Department of the Y. M. C. A. at Silver Bay. As a result, the last two meetings of the club, which have been unusually successful, have included a simple supper, some music, a talk from an outside expert or authority, and then a lively discussion of the responsibilities and duties of supervisors. The leader in a skilful way has refrained from answering questions or expressing opinions, but has drawn the crowd out as to their experiences and opinions, pro and con. Under the direction of the leader one of the class members has officiated at a large blackboard; the high points of the discussion are noted and are thus convenient for ready reference during the discussion. It is a little bit difficult to get discussions of this sort started and under way, but soon enough interest is inspired so that the members generally enter into the discussion and debate with considerable enthusiasm and eagerness. The chances are that the discussion will be extended over into smaller groups for several days following the meeting. Does not this promise the best sort of practical results and is it not something toward which all of the foremanship clubs and classes should aspire?

A "slow order" on shop scheduling

About ten or fifteen years ago the "efficiency expert" enjoyed a much greater degree of popularity than he does today. This is not because the demand for efficiency has decreased, but probably because of the abuse of the prestige that the title enjoyed at that time. The efficiency engineer of that period laid the foundation for many ideas which have resulted in the remarkable development of modern industry. In certain fields of endeavor, notably that of the automotive industry, the application of the principles of scientific management has made possible the quantity production which has been a big factor in its rapid development. It will be remembered by many present-day railroad officers that several of the larger roads of this country engaged the services of efficiency experts to study railroad shop operating conditions and submit recommendations for improvements in practice. It may also be recalled that unfortunately many of these recommendations proved impractical. This was not necessarily any reflection on the initiative and ability of the men who made the recommendations but was due possibly to a lack of understanding on their part of the conditions surrounding the industry they were trying to serve.

The railroads at that time had not yet been faced with the urgent need of increased efficiency such as exists today. Neither had the automobile industry been developed to its present-day stage wherein it could have served as a concrete example of the value of scientific management. In short, the efficiency engineer of 1910 was forced to sell his idea to the railroads on theory alone in the face of a "market" which lacked the element of demand.

There is a present-day demand for increased railroad shop efficiency that is equally as marked as the demand for industrial plant efficiency. The effort to meet this demand has led many railroad shops to install scheduling systems. Some of these have served their purposes remarkably well while others have failed and, in failing, left those who have tried them doubly skeptical as to the value of any scheduling system.

In an endeavor of any kind an impartial analysis of the causes of failure may prove far more valuable than a study of successful methods if for no other reason than that attendant conditions must of necessity be taken into consideration. Is it not possible that some present-day shop supervisors fail in their efforts to install "efficiency" systems for the same reason that the efficiency engineer of 1910 failed—because each lacks a thorough knowledge of the principles of the other's business?

Modern industry profits by the efforts of thoroughly trained industrial engineers. The most successful of these men are those trained first, in the fundamental principles of industrial management and second, in a thorough knowledge of the conditions surrounding the industry they strive to serve. What systematic efforts are the railroads making to train their own "industrial engineers"?

Shop schedule systems may either contribute to a reduction in maintenance of equipment expenses or become a source of loss, depending on the intelligence used in their application. Shop scheduling is attracting widespread attention among railroad shop men and now is the time, before too many costly errors are made, to train men specially for this field of railroad shop work. It is neither necessary nor desirable for a shop superintendent or general foreman to add to his already arduous duties the responsibility of developing a scheduling system. Some of the money occasionally wasted in cut-and-dry methods might more profitable be expended in the training of one man or a group of men—first, in the principles of shop management, and second, in the conditions under which their own and other similiar shops must operate. This having been done, all that is needed is the whole-hearted backing of the officer who has the proper authority, to get results without wasted effort.

A Finish Fight!

Almost twenty-one years ago George M. Basford made his remarkable address on "The Technical Education of Railroad Employees—The Men of the Future," before the American Railway Master Mechanics' Association. Mechanical department officers on two roads at least, caught its full significance and started actively to install modern apprenticeship systems, in line with Mr. Basford's suggestions. John Purcell on the Santa Fe had always taken a deep interest in the welfare and progress of apprentices. Frank Thomas, engineer of tests on the Santa Fe, with a splendid technical training and a big heart, was assigned the task, under the direction of Mr. Purcell, of developing and applying the methods suggested by Mr. Basford. J. F. Deems, general superintendent motive power of the New York Central Lines, called Mr. Basford into consultation and together they worked out a plan to meet the needs of the apprentices on that system. It will be recalled that the roads forming the New York Central Lines were not as closely associated as they are today and considerable diplomacy and tact were required to extend

the new apprenticeship methods to all of them. C. W. Cross, master mechanic on the Lake Shore & Michigan Southern at Elkhart, Ind., like Mr. Purcell on the Santa Fe, had shown unusual interest in the apprentices; moreover, he was widely acquainted with the mechanical department officers of the New York Central Lines and was possessed of considerable diplomacy. He was chosen to head up the apprenticeship work on the system, and selected as his associate an educator, Walter B. Russell, now director of Franklin Union, Boston, Mass., to develop the school work courses.

Mr. Basford when he made his address in June, 1905, was editor of the American Engineer and Railroad Journal, now the *Railway Mechanical Engineer*. A few months later he gave up editorial work and became associated with the American Locomotive Company. During the remainder of his life, however, he continued to be an enthusiastic promotor of modern apprenticeship methods.

In 1908 a committee on apprenticeship recommended to the American Railway Master Mechanics' Association a number of basic principles which it believed to be vital to the success of an apprentice system. This report was adopted and these principles today stand as recommended practice of the Mechanical Division of the American Railway Association.

The American Engineer and Railroad Journal and its successor, the *Railway Mechanical Engineer*, have continued to advocate more or less aggressively during the past twenty years that greater attention be given to the training of shop apprentices. During these twenty years they have presented some noteworthy contributions to the literature on this subject. The progress of apprenticeship on the railroads has been followed closely. In 1907, for instance, a series of articles was published covering the details of apprenticeship methods on the New York Central Lines which attracted widespread attention. Articles have been published at various times covering the proceedings of the apprentice instructors' annual conferences on both the New York Central and the Santa Fe. A series of articles covering the apprenticeship work on the Santa Fe, after long years of experiment and development, was published in the *Railway Mechanical Engineer* in 1924. Two competitions, one for the regular apprentices and another for the special apprentices, were held in 1923, in which an attempt was made to have the young men, themselves, tell what they thought about apprenticeship and its shortcomings, and how the methods and practices could be improved. Our expectations were more than fulfilled in the type of material submitted in these competitions and the result was the demonstration of a greater interest in apprenticeship on several different railroads.

The conditions in the railroad shops during the war and post-war periods and the shop strike in 1922, rather seriously complicated the situation so far as apprentice training was concerned. After the strike several of the roads started to take a greater interest in the apprentices, and a number of them made a study of conditions on the Santa Fe and adopted its methods, at least in part. The work which was so well started on the New York Central and which continued in a large way for a number of years, slumped off to some extent even before the war, but fortunately it was so strongly intrenched that the local shops carried it on with more or less success, although without much overhead supervision. More attention has been given in recent years to apprenticeship, however, on the basis of the system as a whole.

One result of the tendency to recognize more and more the importance of the human element in railroading, has been to focus greater attention upon the problem of leadership and the necessity of paying more attention to providing better workers for the future. The past few years have, for instance, seen the development of a large number of foremen's clubs or foremanship and leadership training classes. The *Railway Mechanical Engineer* has had an important part in this development, culminating in the rather heated controversy during the past year between the adherents of "Bill Brown" and "Top Sergeant."

We have been trying to find some way of focusing similar attention upon the need for preparing better workers for the future, and the first gun is being fired in this issue. One shot is in a communication on the Readers' Page, in which the writer comments upon the shortcomings of some of the apprentice systems. The second shot is an article by C. Y. Thomas, supervisor of apprentices of the Kansas City Southern, in which he suggests why it is that there has not been a more rapid extension of modern apprenticeship methods. He also makes a constructive suggestion for a remedy. C. Y. Thomas is one of the younger group of apprentice supervisors and is a son of Frank Thomas, of the Santa Fe.

Without realizing that we were starting this campaign, two other of the younger apprentice supervisors have furnished us with articles which will be published in our April and May issues. All three of these young men are making a decided success of their work. All three have studied modern apprenticeship methods thoroughly and have been seeking to find ways and means of making their methods and practices more effective. Each one of these men has given us his best thought without any reference to the others or knowledge that they were to contribute.

Our whole aim has been to present the most constructive material that we could discover on apprenticeship methods, with an idea of stimulating greater interest in apprenticeship. We hope that our readers will discuss this entire question with extreme frankness. We shall be disappointed if not one, but several "Top Sergeants" do not bob up and challenge the practices on the different railroads or what the contributors have to say. There are undoubtedly some who question the value of apprenticeship at all. We hope that they will feel free to take issue with us. Now, if ever, is the time to go to bat on this question and clear it up. Twenty years of trial are surely enough to have demonstrated beyond a question of doubt the advantages or disadvantages of modern apprenticeship methods. What are the railroads going to do about it?

Improving the locomotive

Few important innovations in the construction or functioning of the steam locomotive have been brought forth full fledged. The limitations of space and weight so restrict the design, and the effects of the highly variable conditions under which the locomotive must operate are to so large an extent evaluated on a wholly empirical basis—where they can be evaluated at all—that the most experienced opinion as to the consequences of any major departure from the well beaten path must contain many speculative elements. What on paper is a wholely plausible project for a highly desirable locomotive improvement raises many questions which can be satisfactorily answered only by construction and then by operation and maintenance under conditions of every-day railroad service. The chances are very great that success will not crown the first effort and that another trial—perhaps several retrials—will be necessary before the changed construction, whatever it may be, has been

adapted in all its details to meet the requirements and withstand the abuses of railway service. The process is a slow and painful one and it is not surprising that railway officers, particularly those in the mechanical department, have acquired their reputation for great conservatism.

The first requirement of a railroad organization is to provide transportation service with whatever tools are available under the existing state of the art. The development of inventions must be a secondary matter. Furthermore it is a highly speculative occupation. Under existing public regulation the reward of success is not always sufficient to justify risking the losses of failure.

Progress, however, can not be obtained without the assumption of some risk on the part of individual railroads and railroad officers. This is true even where the greatest risk is assumed by private enterprise, outside of the railroad organization, because without the support of a railroad in furnishing the field for practical development, the best organized private enterprise can do nothing. The need, however, is not so much for greater liberality in offering opportunities for initial tests as it is for greater courage in following a development, once started, through to conclusion. Many valuable ideas have either been lost or their ultimate development delayed for years because of a lack of discrimination between inherent difficulties and mere weaknesses of form or arrangement possible of correction. The officer who is sufficiently convinced of the value of an idea to give it an initial trial, but who is not prepared to face several repetitions of the original trial, in none of which complete success may be obtained, is rendering no real service to progress. Only those who have the courage of their original convictions and the patience to withstand the disappointments of development should become a party to the original installation and trial.

A typical instance of the laborious nature of the process of developing locomotive improvements will be found in the case of the McClellon water-tube firebox, carried out on the New York, New Haven & Hartford, and a description of which will be found on another page of this issue. After a wait of ten years, the full practicability of this type of firebox construction seems now to be established. During this decade there was the usual sequence of initial failure, painstaking development and reconstruction to provide for the effect of conditions which at the outset were either entirely overlooked, or at least greatly underestimated, then years of service to see what further unexpected difficulties of maintenance might develop, and finally after a redesign to eliminate the patch work necessarily a part of the development stage and to take advantage of improvements in other directions made possible by this type of construction, there were tests to measure its value as an operating factor. The operating and maintenance results are ample justification for the persistence with which the development has been seen through to its conclusion. Nothing but loss would have resulted had the initial lack of success been interpreted as final.

Most of the improvements in the steam locomotive during the past quarter of a century have essentially involved no changes in the locomotive itself, but have largely constituted additions to the locomotive. Recent developments suggest that we are entering a new era of locomotive development in which many proposals will be brought forward involving marked changes in the locomotive itself, such for instance, as the four-wheel trailer and the McClellon firebox itself. The growing appreciation of the economic posibilities of high steam pressures may be cited to indicate the direction in which some of these changes may tend. The water-tube firebox, such as that just referred to and that developed by John Muhlfeld for the "Horatio Allen," have removed the present firebox limitation on boiler pressure, but no great advance in pressure can be made without some substitute for the present firetube barrel portion of the boiler.

If such possibilities as that suggested by high steam pressure are ever accomplished, it will be only because some railroad and its officers are willing to lend constructive aid in the development of what may be major modifications in construction when proposals promising practical results are brought forward. No matter who may take the major risk and reap the major reward, a very great and very definite responsibility for progress in locomotive development rests squarely on the shoulders of railway officers.

New Books

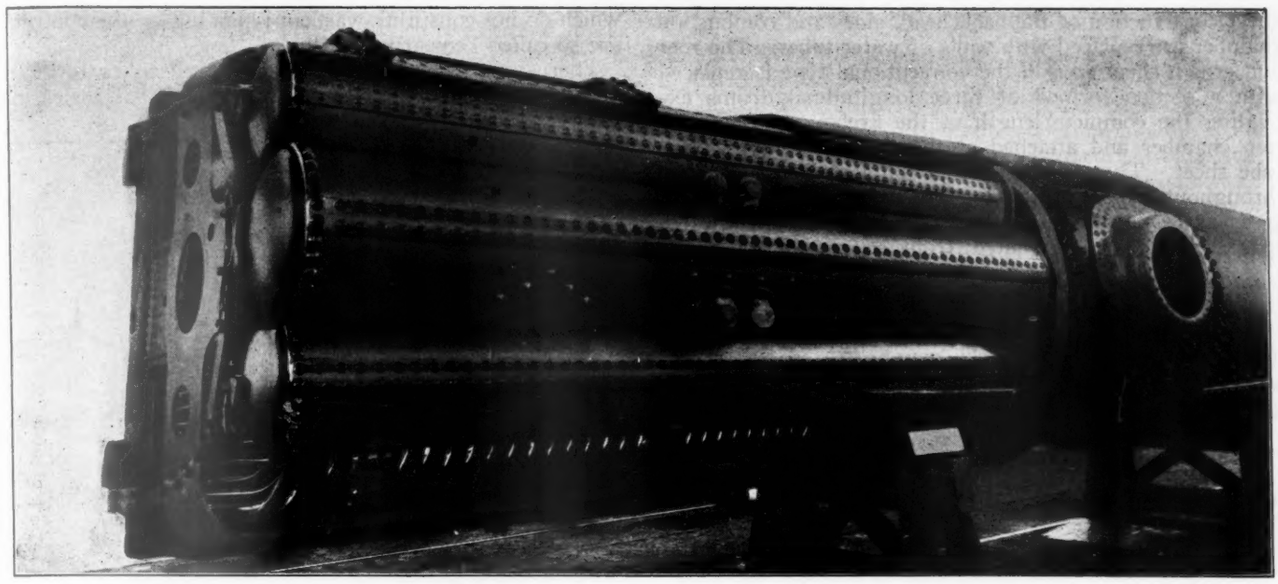
Draft and Capacity of Chimneys. *By J. G. Mingle, Civil Engineer, 344 pages, illustrated, 5¼ in. by 8 in. Price $3.50. Published by D. Van Nostrand Company, 8 Warren Street, New York.*

In developing the theory of draft and capacity, the author has dissociated the two entirely; that is he has assumed that the height of the chimney is dependent only on the draft requirements and the diameter only on the capacity requirements, although each has a secondary influence on the other. This means of organization will particularly appeal to the designer of power plants who is desirous of investigating all of the conditions to which his contemplated chimney may be subjected as well as to the operator of power plants who must check the size of his existing chimney with the view of eliminating draft and capacity shortcomings. The work is carefully illustrated with graphs and diagrams.

There are fourteen chapters. In them the author has developed his theoretical data simply and directly and has amplified it with experimental information on performance and thus developed a series of practical hints which will aid materially in the proper construction of chimneys.

Tool Foremen's Proceedings.—*Edited by G. G. Macina, secretary, 11402 Calumet Avenue, Chicago, and published by the American Railway Tool Foremen's Association. Imitation Leather, semi-flexible binding, 178 pages, 5 in. by 9 in., price $2.50*

This book contains the proceedings of the thirteenth annual convention of the American Railway Tool Foremen's Association and in a number of respects is a marked improvement over any volume previously issued. The proceedings have been carefully edited to eliminate a large proportion of the more or less extraneous discussion, and as a result it is relatively easy to follow the trend of the discussion as well as the conclusions reached. Particularly valuable information on machine tool equipment for toolrooms of various size is included, as well as reports of various standing committees which have been assigned important topics. Special interest also attaches to the report of the Committee on Standardization which offered definite recommendations for standard locomotive rod and frame reamers subsequently adopted by the association. In addition, the volume contains drawings and photographs of a considerable number of labor-saving shop jigs and devices. The table of contents enables any of the reports to be located quickly and a general index in the back of the book affords ready means for locating the remarks made by individual members. Every tool foreman should possess one of these volumes to keep in touch with the work of his association, and the present volume would be a good one with which to start a file because it is the first to have this particular type of binding with the initials of the association and year shown on the backbone.



Top of the firebox and combustion chamber—Note the heavy plate cross-member on the back head

McClellon water-tube boiler shows good results

Developed on New Haven, the locomotive shows improved thermal efficiency and greater capacity

IN 1916 the New York, New Haven & Hartford, placed in service two Mikado type locomotives fitted with McClellon water-tube fireboxes, of the type for which a patent was granted to the late James M. McClellon, and is now owned by the McClellon Boiler Company, Boston, Mass. These two boilers met with indifferent success. The original design developed some weaknesses in the details of its construction but showed that its fundamental principles were mechanically sound and that with a modification of the details that were giving trouble, the boiler would probably give satisfactory service. Unfortunately, Mr. McClellon died at this time, just as the boiler had demonstrated its possible practicability.

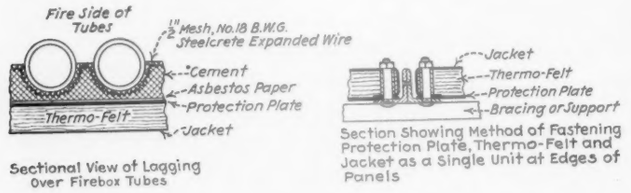
W. L. Bean, mechanical manager of the New York, New Haven & Hartford, feeling confident that this type of firebox construction possessed advantages over the ordinary radial-stayed firebox, undertook to study fully and to correct the troublesome features which had become apparent in actual service. These changes were made in 1920 to the two original boilers, which are still in service. In 1924, having 10 mountain type locomotives on order with the American Locomotive Company, it was decided to equip one of these locomotives with the McClellon firebox, embodying such changes in the structural design as had already been made in the two existing boilers, and including further modifications which were felt might prove to be advantageous.

Realizing that this design of boiler is particularly adaptable to high pressures, one of the modifications made in the new locomotive was to increase the boiler pressure to 250 lb., which, with the use of a 70 per cent limited cut-off, would give greater steam economy. Viewed from the standpoint of the present design, it is of very simple construction and well adapted to meet and properly withstand the stresses inherent in locomotive service.

The character of the construction is clearly shown in the illustrations. It will be seen that the ordinary parallel

The construction of the back boiler head—Note the pads on the channel braces to which the heavy plate cross member is bolted

sheet construction of the back head, sides and combustion chamber are replaced with walls of water tubes. The roof and crown sheet area in the conventional type is replaced with a section formed of three longitudinal drums extending the complete length of the firebox and combustion chamber and attached at the front end to the rear tube sheet. These drums are in contact with each other throughout their length and are so flattened at the contact areas as to permit the largest possible steam and water space. They are prevented from separating by screw



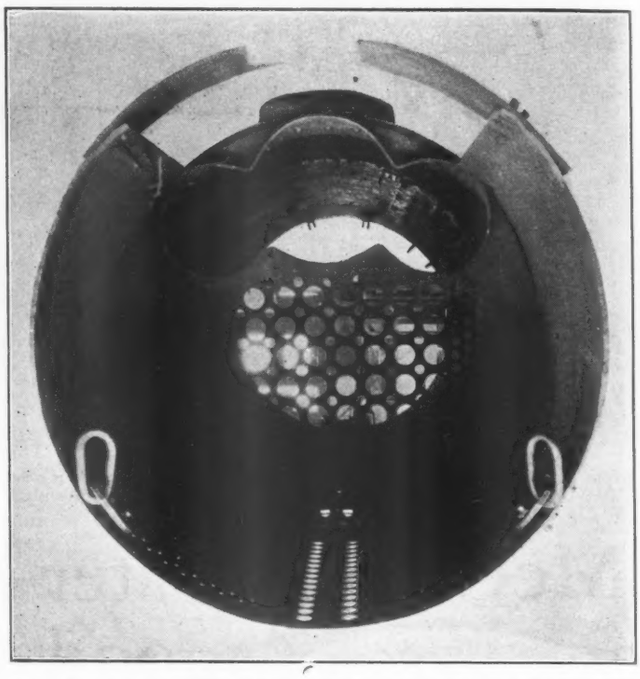
Details showing the construction of the firebox enclosing wall and the method of attaching the lagging and jacket in panel units, to a framework of angles supported on the firebox braces—The usual type of asbestos lagging and jacket are applied over the top and ends of the drums

rivets that keep the flat sections in continuous contact throughout.

Combustion chamber and side tubes are 4 in. in outside diameter, swedged to 3 in. at the ends, with walls ¼ in. thick. The back head tubes are 2 in. in outside diameter for their entire length, with walls 3/16 in. thick. All tubes are rolled and beaded at the top ends in the drums, but are rolled and flared in the mudring at the bottom ends. The arch tubes are conventional in size but at the top the ends are turned up into the drums and rolled and beaded. All tubes entering the drums are on the drum radius and perpendicular at the point of entrance.

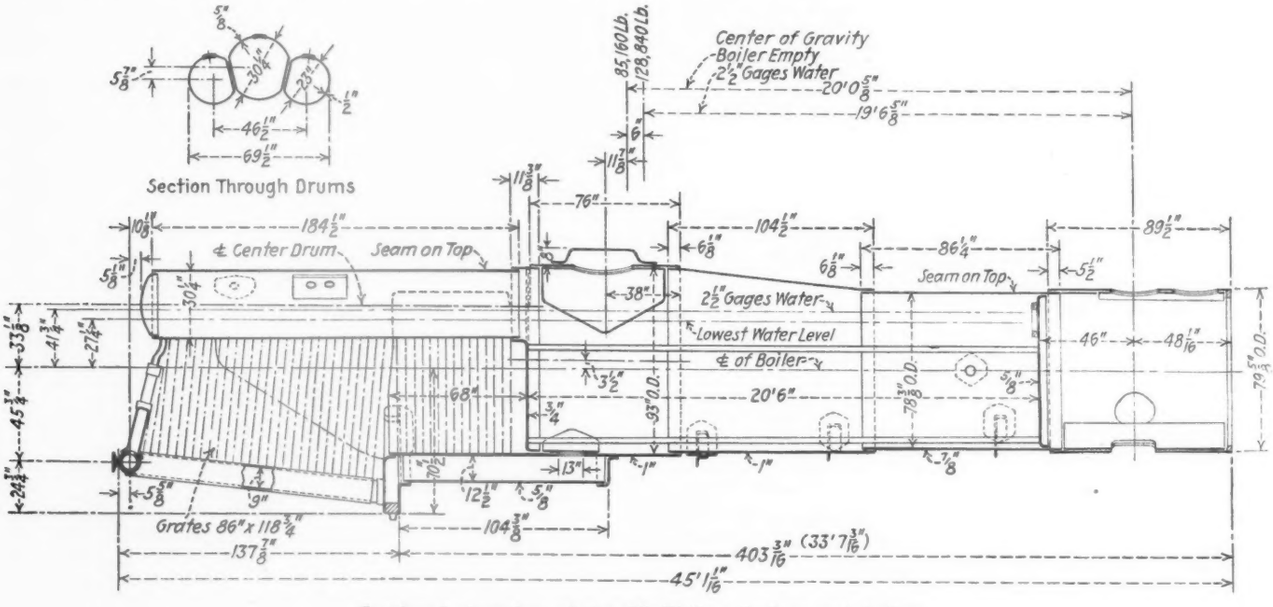
To accommodate proper seating of the tubes in the mudring, the top wall is flattened inside and outside. The outside of the bottom wall also is flattened. Through it holes are tapped opposite each tube to permit the initial installation of tubes and such inspection and maintenance as may be necessary. These holes are closed with plugs, all of which do not constitute washout plugs but on the contrary are so-called "construction plugs."

There is a slight clearance between all tubes forming the firebox construction in order to permit of easier in-



Interior of the combustion chamber dry shell, showing the opening in the tube sheet for the firebox drums

stallation. Lagging and protection is applied on the sides and back head, outside of the tubes, to which reference will be made later. All back head tubes are staggered at the entrance into the drums because of the relatively restricted section forming the crown, as compared with the length for tube spacing available in the mudring.

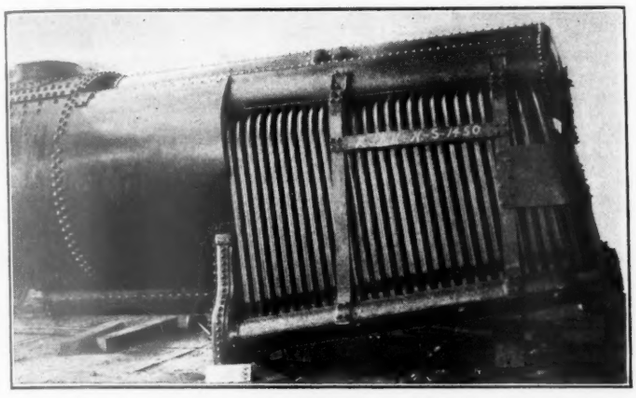


Sectional elevation of the McClellon firebox and boiler

The illustrations given are all taken from locomotive 3500, which is equipped with a Duplex stoker. Several of the back head tubes are bent away from their normal posi-

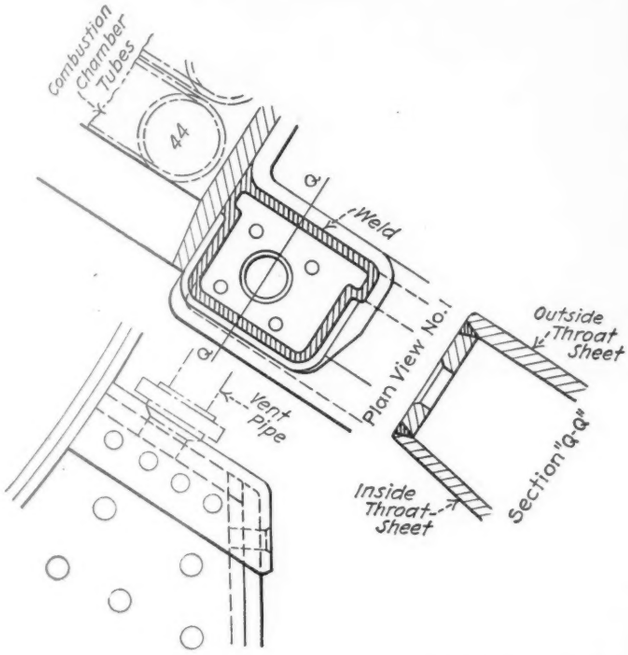
tion in order to permit entrance of the stoker distributor tubes. This construction is used where the Duplex stoker is applied but is not used when the Standard stoker or similar types are applied.

The fire door opening is a combination water-leg and water-tube construction. The section below the door is of a conventional stayed construction. It is made up in three



Side of the completed firebox

pieces: a single inverted U-shaped piece flanged and riveted to the mudring, with the ends closed by semi-circular sheets bent and riveted in place. The sides of the door opening are formed by large tubes joining the stayed section at the bottom and connected near their upper ends by the top door member which is formed rectangular in



Method of closing throat sheet corners—A plate is first welded in the opening, the lap of the sheets at the end of the throat is smoothed by welding and scarfing, and the flanged cap fitted in place hot, after which it is secured by screw rivets and welded to the dry shell and to the inside plate at the edges of the vent opening—The opening is then reamed and the studs applied

section from round tubing. Regular 2-in. tubes are carried from the top member of the door frame up to the drums in the same manner as the main back head tubes, with plugs located on the underside of the rectangular member opposite tube holes. The large side tubes are capped at their top ends with steel castings, welded in place, into each of which two 2-in. tubes are applied and carried up to the drums.

One of the troubles with the original construction was lack of provision for any column action to take the stresses between mudring and drums independently of the tubes. This situation is avoided by a series of braces between the mudring and the drums so arranged as to form, in combination with the drums and mudring, a hollow box girder type construction. This relieves the tubes of any duty other than that of steam and water containers under pressure. Shocks incident to locomotive service are transmitted through this bracing construction and kept away from the tubes, so that they remain continuously tight, even under severe and unusual operating conditions. The braces at the sides of the firebox are of channel section secured with fitted bolts to the mudring and to castings applied to the drums. The braces are seated against

Interior of the firebox before the walls were closed

shoulders so that the bolts are relieved of shear. Horizontal members of rectangular section connect the main side braces to give additional stiffness.

The arrangement of bracing, being free from triangulation, permits the necessary free longitudinal movement of drums relative to the mudring resulting from temperature differences between the mudring and crown sheet areas. Similar construction is employed at the back head. The top connections of the back head braces into the saddle castings on the drum heads are so arranged as to permit inspection and attention to the seams between drums and drum heads. An arch effect is obtained through the use of the diagonal braces which connect the column members to the center drum.

A back head belt of wide plate section is bolted to the back head braces and carried around the corners of the firebox to the rear side braces. This not only forms a part of the back head bracing, but serves as a foundation on which all of the back head and cab fittings are applied.

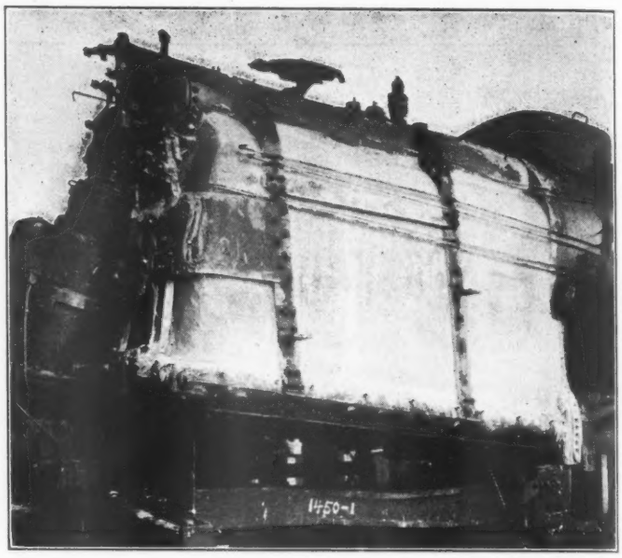
The throat sheet at the front end of the firebox is generally similar to the ordinary throat sheet in com-

ventional boilers, except that it is vertical and is arranged to give greater accessibility for washing out. The back plate of the throat is flanged outwardly to receive the front ends of the hollow mudring, and opposite the mudring connections, the front throat sheet is fitted with hand hole plates similar in construction and arrangement to those used in marine and stationary practice. The top points at the sides of the throat are fitted with caps and vented through copper pipes which permit the escape of steam into the steam space in the central drum. One of the drawings shows a detail of this construction.

The combustion chamber, like the firebox, is of water-tube construction, but it is encased in a dry shell extension of the third barrel course. This course provides the structural strength for the connection of the firebox and the barrel portions of the boiler. It will be seen in the photographs that at the top it is securely riveted to the two outside drums throughout the length of the combustion chamber and that the inside and outside throat sheets are riveted to it at the bottom. The rear tube sheet is also riveted in this course with the flange extending forward into the water space. It is flanged in the opposite direction to receive the front ends of the three drums which form the top of the firebox, no flanging or swedging of the drums being required. To permit the caulking of the tube sheet flanges at the sides of the two outside drums where the dry shell overlaps the flanges, a recess has been cut in this shell. The opening thus made into the combustion chamber is closed with a fitted cover plate, to prevent the escape of gases into the lagging.

To permit the transfer of water from the barrel of the boiler to the firebox and combustion chamber a circulating trough is riveted on the outside of the third course at the bottom. The front end extends ahead of the tube sheet and opens through the shell into the boiler, while the rear end is riveted into a flanged opening in the outside throat sheet.

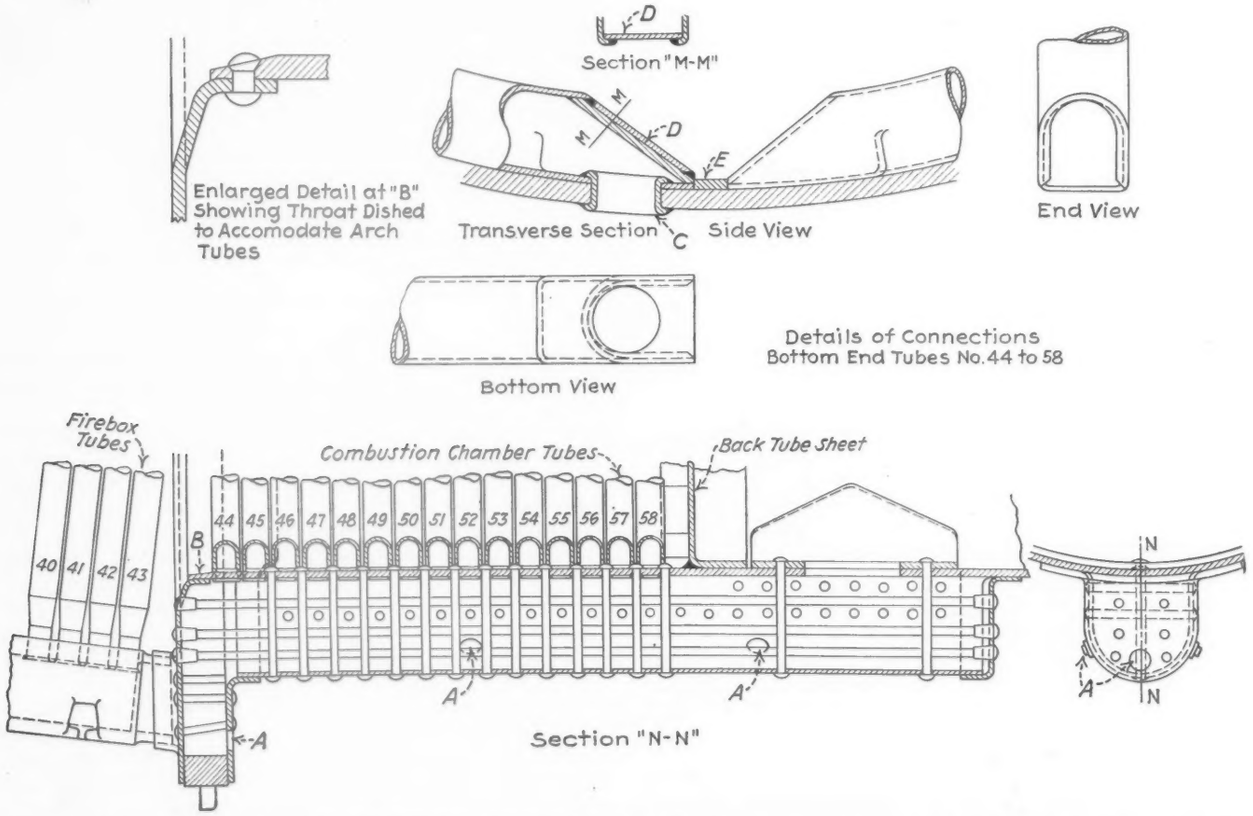
All combustion chamber tubes enter the side drums at their upper ends in line with the firebox tubes. The bottom ends of all except the rear tube on each side open to the



The firebox walls closed, ready for the lagging and jacket

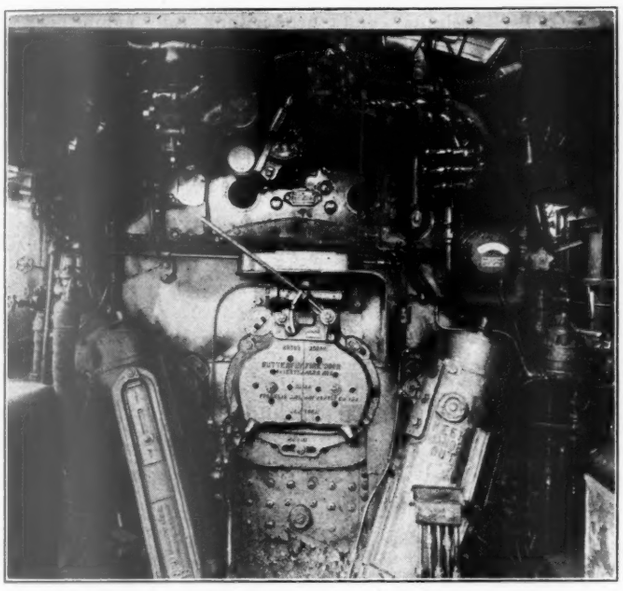
circulating trough through holes in the dry shell. The rear tubes open directly into the throat sheet water space.

The attachment of the combustion chamber tubes to the circulating trough involves a unique type of construction,



Circulating trough and combustion chamber tube construction—Washout plugs as shown at A; circulating nipple at C; combustion chamber tube end at D, and space block to relieve nipples of shearing, at E

which is shown in detail in one of the drawings. The tubes are flattened and curved to fit the dry shell at the bottom and their ends are cut away on an angle. A hole through the flattened wall of the tube fits over a nipple, applied through the hole in the dry shell and rolled, beaded and welded, before the circulating trough is in place. The upper end of the nipple is rolled, beaded and welded in the tube, working through the open end of the tube. The end of each tube is closed by plate welded in place, over which

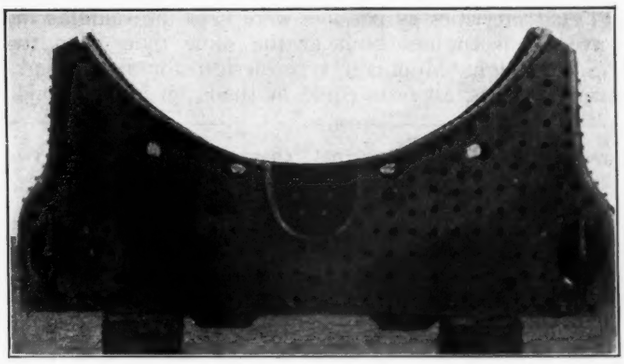


When lagged, the boiler head does not differ in appearance from that of a staybolt type firebox

the edges of the tube are flanged and welded. A space block is applied between the right and left tubes of each pair to relieve the nipples of shearing action.

The lagging on the outside of the firebox is composed of a protection plate, insulation and jacket. The lagging is made up in sections with each panel self-contained in order to permit the removal of lagging in sections without the necessity of wholesale stripping for access to tubes and other parts. The lagging is applied after the tubes have been covered with an asbestos cement.

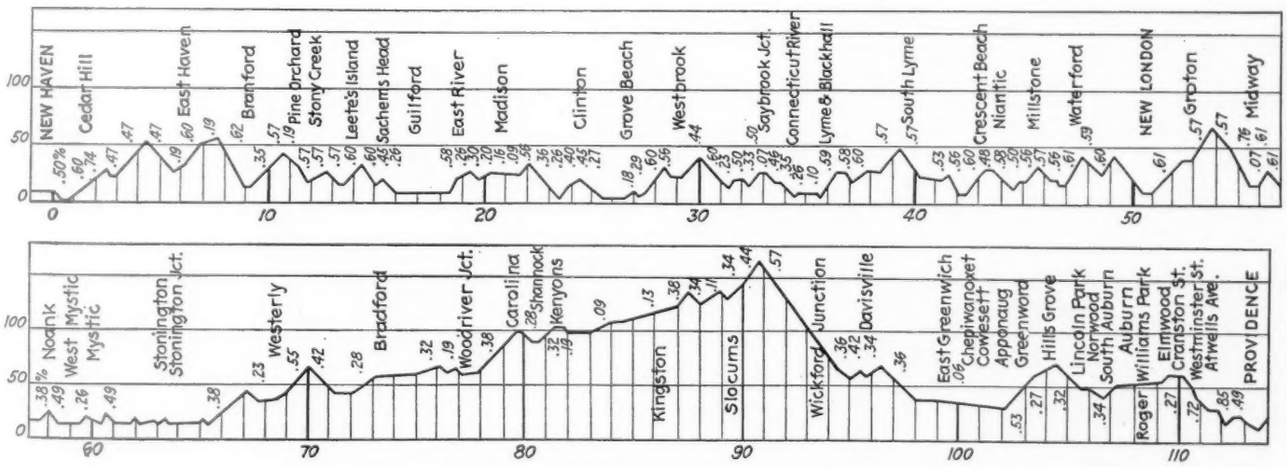
No detailed study has been made of circulation in this boiler, but observations of the bare boiler, fired-up during construction and without any lagging or insulation whatever, indicate a very uniform warming up of the entire boiler from front end to back head without the usual unequal heating normally experienced in the radial-stayed construction. The time required to fire up the cold boiler is only two-thirds of the time usually required with the radial-stayed construction. There is a very noticeable scouring action through the tubes of the firebox and combustion chamber, undoubtedly due to the rapid and positive circulation and indicated very definitely by lack of mud and scale in the mudring and tube area. Most of the mud accumulated is relatively soft and is deposited in the



The front side of the throat construction, showing the handholes and circulating trough flange—The mudring flanges are opposite the handhole openings

trough section. In other words, the dead corners of the conventional boiler and firebox are absent in the McClellon construction.

The freedom from unequal heating, momentary distortion of the firebox while warming up, more rapid circulation and absence of dead corners that give rise to mud and scale accumulation all indicate a better type of boiler construction than normally used. The time required to wash one of these boilers is only about one-half or two-thirds of the time required for the ordinary boiler. Stresses due to unequal temperature conditions are greatly reduced as indicated by considerably less maintenance on the firebox and combustion chamber portion of the boiler. Both running and back shop repairs are less on the boilers with this type of firebox than on those with the conventional type of firebox. The ten years' experience of the New Haven indicates that the maintenance cost is reduced



Profile of the division over which the dynamometer tests were run

about one-half, and there is also a considerable increase in the time available for service.

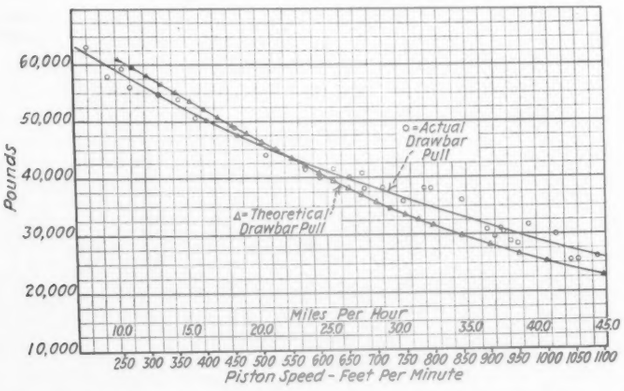
There is greater potential capacity in this type boiler when the locomotive is running before low steam conditions are experienced from any cause than is the case with the conventional locomotive boiler.

The arrangement of outside throttle and superheated steam on most of the auxiliaries is in keeping with present day practice. An Elesco feedwater heater and Duplex stoker are applied, the front end is fitted with Okadee hinges and the air operated whistle uses superheated steam.

When this locomotive was built as many dimensions and characteristics as possible were kept the same as the conventional engines built at the same time from the U.S.R.A. light Mountain type design for fast freight service. Thus, all tests could be made on a comparable basis as between the McClellon firebox and the standard locomotive, thereby eliminating variables that would tend to influence conclusions. Consequently, the cylinder and wheel sizes, grate area, heating surface, superheater surface, etc., were all kept at the same values and the changes in the McClellon equipped locomotive were confined to the firebox arrangement, boiler pressure, valve events and, to some extent, the weight on drivers. Virtually the same limitation on axle loads held good for the McClellon equipped engine as were imposed in the case of the standard type.

Comparison of the principal characteristics of the two locomotives tested

	Engine 3324	Engine 3500
Type	4-8-2	4-8-2
Boiler	Firetube	Firetube
Firebox	Radial-stayed	McClellon
Weight on drivers	230,500 lb.	243,500 lb.
Total weight, engine and tender	518,800 lb.	549,000 lb.
Boiler pressure	200 lb.	250 lb.
Cylinders	27 by 30 in.	27 by 30 in.
Maximum cut-off	85 per cent	70 per cent
Diameter of driving wheels	69 in.	69 in.
Tractive force	53,900 lb.	63,390 lb.
Factor of adhesion	4.28	3.81



A comparison of the theoretical and actual drawbar pull curves for engine 3500

After receipt from the builders in 1924, this locomotive, road No. 3500, was placed in regular freight service and was later subjected to extensive tests in comparison with one of the standard engines, road No. 3324. The tests with both engines were conducted over the same division, from New Haven, Conn., to Providence, R. I., a distance of 113 miles. It will be seen from the accompanying profile that eastbound, with the exception of a start at each end of about three miles, and the climb from Wood River Junction to the summit a mile east of Slocums, a distance of 14 miles, and westbound, from East Greenwich to the same point, a distance of about seven miles, all of the adverse grades may be considered as momentum grades. The profile shows a continued succession of favorable and adverse grades, very few of which are more than two miles long. Particular pains were taken to have all readings the same during both tests, and to have them taken at the same predetermined locations throughout the series of runs. All coal used was accurately weighed by means of scales placed on the tender and was of the same quality for all runs. The average heat value was close to 13,500 B.t.u. per lb. of dry coal.

One of the tables gives a comparison of the principal dimensions of the two locomotives tested. It will be seen that although both have the same cylinder dimensions, engine 3500 had the advantage of 50 lb. per sq. in. in steam pressure, with a consequent higher tractive force of about 17.6 per cent. This higher tractive force is obtained with an increased weight on drivers of only six per

Dimensions, weights and proportions of engine 3500, equipped with McClellon firebox

Type of locomotive	4-8-2
Service	Freight
Cylinders, diameter and stroke	27 in. by 30 in.
Valve gear, type	Southern
Valves, piston type, size	14 in.
Cut-off in full gear, per cent	70
Weights in working order:	
On drivers	243,500 lb.
On front truck	59,500 lb.
On trailing truck	57,000 lb.
Total engine	360,000 lb.
Tender	189,000 lb.
Wheel bases:	
Driving	18 ft. 3 in.
Total engine	40 ft. 10 in.
Total engine and tender	76 ft. 5½ in.
Wheels, diameter outside tires:	
Driving	69 in.
Front truck	33 in.
Trailing truck	43 in.
Journals, diameter and length:	
Driving, main	12½ in. by 14 in.
Driving, others	10½ in. by 14 in.
Front truck	6½ in. by 12 in.
Trailing truck	9 in. by 14 in.
Boiler:	
Type	McClellon
Steam pressure	250 lb.
Fuel, kind	Bit. coal
Diameter, first ring, outside	78⅜ in.
Firebox, length and width	120 in. by 85 in.
Height mud ring to crown sheet, back	63¾ in.
Height mud ring to crown sheet, front	98¾ in.
Arch tubes, number and diameter	4—3 in.
Combustion chamber length	68 in.
Firebox tubes, number and diameter—	
Sides	58—4 in.
Back	28—2 in.
Combustion chamber	30—4 in.
Tubes, number and diameter	201—2¼ in.
Flues, number and diameter	40—5½ in.
Length over tube sheets	20 ft. 6 in.
Grate area	70.8 sq. ft.
Heating surfaces:	
Firebox—	
Drums	81.8 sq. ft.
Back section	46.5 sq. ft.
Side and back tubes	187.0 sq. ft.
Combustion chamber tubes	115.8 sq. ft.
Arch tubes	27.0 sq. ft.
Total	458.3 sq. ft.
Tubes	2,469 sq. ft.
Flues	1,134 sq. ft.
Total evaporative	4,061 sq. ft.
Superheating	1,009 sq. ft.
Comb. evaporative and superheating	5,070 sq. ft.
General data estimated:	
Rated tractive force, 70 per cent cut-off	63,390 lb.
Cylinder horsepower (Cole)	3,090
Steam required per hour (Cole)	58,710 lb.
Boiler evaporative capacity per hour (Cole)	63,072 lb.
Weight proportions:	
Weight on drivers ÷ total weight engine, per cent	67.7
Weight on drivers ÷ tractive force	3.81
Total weight engine ÷ comb. heat. surface	71
Boiler proportions:	
Boiler hp. ÷ cylinder hp., per cent	107.2
Tractive force × dia. drivers ÷ comb. heat. surface	862.7
Cylinder hp. ÷ grate area	43.7
Firebox heat. surface ÷ grate area	6.5
Firebox heat. surface, per cent of evap. heat. surface	11.3
Superheat. surface, per cent of evap. heat. surface	25.0

cent, or in other words, with a reduced factor of adhesion. The locomotive required no more care in handling than the other engines with the higher adhesion factor because of the smoother torque resulting from the relatively shorter cut-offs.

The first tests with engine 3500 were conducted to establish the maximum tonnage which the engine was capable of handling. Starting with 4,000 equated tons on a 75-car basis, the load was increased to 6,547 equated tons. The engine started and accelerated this train without difficulty on a .142 per cent grade. Tests with greater tonnage were prevented by lack of available tonnage because of the coal strike and the maximum capacity of the locomotive is still undetermined.

A typical indicator card, shown in one of the diagrams, was taken at a time when the engine was hauling 4,496 tons, 85 cars, up a 0.4 per cent grade, just east of Saybrook. The cut-off is given at 70 per cent of the stroke, the speed at 3 m.p.h. The section of the dynamometer car chart shows a very uniform drawbar pull along with uniform acceleration while raising speed up to 8½ m.p.h.

A comparison of the outstanding items in the performance of the two locomotives taken from the summary of the efficiency tests is given in a table.

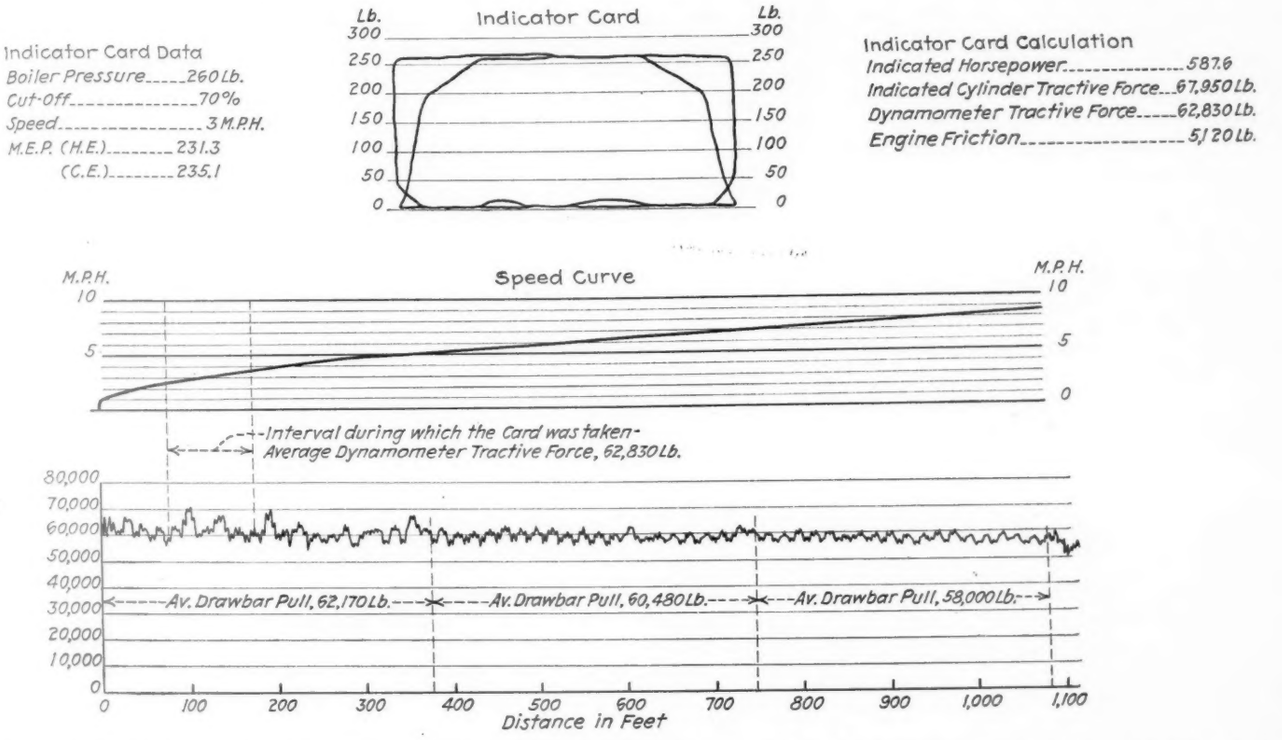
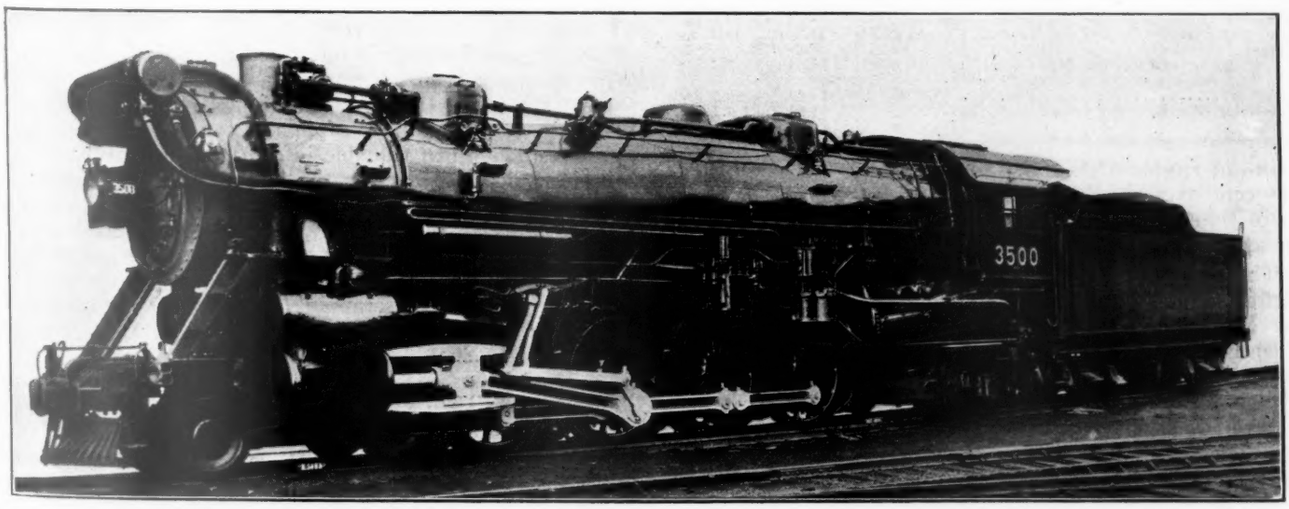


Chart showing the drawbar pull of engine 3500 on a .4 per cent grade east of Saybrook, Conn., starting and accelerating a train of 85 cars and 4,496 tons



New York, New Haven & Hartford 4-8-2 type locomotive with McClellon firebox

From these results it may be seen that engine 3500 hauled 3.2 per cent more tonnage than engine 3324, maintaining the same average speed and the same running time over the division, while working at a 16.5 per cent shorter

cut-off and at the same time used 10.7 per cent less coal than did engine 3324. This resulted in a decrease of 15.1 per cent of coal per 1,000 gross ton-miles. No material difference in superheat was noticed in the tests on the two locomotives.

Because of the higher boiler pressure and limited cut-off of engine 3500, a saving of 5 per cent in pounds of water per dynamometer hp. hour was obtained, which, coupled with the 12.0 per cent increase in evaporation per pound of dry coal, resulted in a decrease of 18 per cent in dry coal per dynamometer hp. hour. The McClellon boiler of engine 3500 shows an increased efficiency of 9.4 per cent over the standard boiler of engine 3324, while there was an increase in overall thermal efficiency of 15.5 per cent in favor of engine 3500.

Summary of the test results

	Eng. 3324	Eng. 3500	Per cent increase or decrease for Eng. 3500
Test Conditions			
Av. running time, min.	254	254	
Av. delayed time, min.	88	106	20.0 inc.
Distance miles	107	107	
Av. number of cars per train	90.5	87.0	3.9 dec.
Av. actual tons per train	4,360.6	4,556.0	4.48 inc.
Av. equated tons per train	4,486.5	4,640.0	3.2 inc.
Av. cut-off per cent	44.8	38.5	16.5 dec.
Locomotive output			
Av. drawbar pull, (integrated), lb.	27,725	29,306	
Million ft.—lb. work at the drawbar	15,669	16,557	5.7 inc.
Dynamometer hp. (true average)	1,872	1,982	5.9 inc.
Fuel performance			
Coal fired, average per trip	23,725	21,400	10.7 dec.
Coal fired, per dynamometer hp.-hr., lb.	2.99	2.55	14.7 dec.
Coal fired per 1,000 gross ton-miles, lb.	50.9	44.4	12.7 dec.
Coal fired per sq. ft. grate per hr., lb.	79.1	71.6	9.5 dec.
Dry coal per dynamometer hp.-hr., lb.	2.95	2.50	18.0 dec.
Dry coal per 1,000 gross ton-miles, lb.	49.96	43.41	13.1 dec.
Dry coal per sq. ft. grate per hr., lb.	77.6	70.0	9.8 dec.
Average thermal efficiency	6.46	7.47	15.6 inc.
Machine performance			
Av. indicated hp. (reading intervals)	2,503.8	2,696.0	7.67 inc.
Av. dynamometer hp. (reading intervals)	2,203.4	2,347.0	6.52 inc.
Machine efficiency, per cent	88.0	87.0	1.1 dec.
Boiler performance			
Av. boiler pressure, lb.	194.8	241.1	24 inc.
Av. superheat, Deg. F.	192.5	196.7	2.18 inc.
Water delivered to the boiler, av. per trip, lb.	181,693	182,339	
Water losses, av. per trip, lb.			
Through feedwater heater pump	3,428	3,880	
Through air pumps	7,364	7,367	
Through safety valves	2,303	1,496	
Through generator	423	423	
Through stoker	3,593	3,599	
Per cent total evaporation delivered to cyls.	90.58	90.79	
Actual evaporation, lb. per hr.	42,963	43,189	0.5 inc.
Equivalent evaporation, lb. per hr.	56,750	56,821	0.1 inc.
Actual evaporation per lb. dry coal, lb.	7.81	8.75	12.0 inc.
Equivalent evaporation per lb. dry coal, lb.	10.32	11.50	11.4 inc.
Actual evaporation, lb. per sq. ft. evaporating surface, per hr.	10.40	10.64	2.3 inc.
Av. lb. water evaporated per dynamometer hp. hr.	22.95	21.8	5.0 dec.
Av. boiler efficiency, per cent	74.59	81.53	9.3 inc.

The results of this service and the tests were so satisfactory and so conclusively demonstrated the advantage of the McClellon boiler that, when ten new engines were recently purchased for the road, there was no question or discussion as to the type of boiler to be used. The McClellon water-tube boiler was ordered to be placed in all of them.

THE SOVIET GOVERNMENT, it is reported from London, is exerting every effort to improve and extend its railway facilities. New construction work at the rate of 3,000 miles per annum is planned. A total of 450 locomotives is reported to be under construction. Extensive tests are being made with Diesel locomotives and several of various types are under order to be tested and compared. The volume of traffic has reached 86 per cent of the pre-war level and is constantly increasing.

Foreman has unlimited opportunities and responsibilities*

By R. J. Wilson

Assistant foreman, Norfolk & Western, Norton, Va.

TO be a successful foreman one must first of all be a diplomat. The foreman is the human link between employer and employee and it is his job to keep the men who work for him and the men he works for happy, congenial and progressive. First of all, to be worthy of his hire, a foreman must win the men who work for him to put forth their best efforts. This requires patience in the nth degree sometimes, to make each man on the job feel that the foreman is interested in each individual and working for his advancement, and to create this same feeling among the men for their foreman.

A foreman, to keep the men contented and willing to exchange their best efforts for their daily wage must realize that his men are real human beings and not machines. A few friendly words of encouragement often help the workmen over hard places and a lift in time of need or an interesting explanation to apprentices makes them feel that you are their friend and brother, not merely a paid overseer. An organization of contented, ambitious men, who have been led to recognize their foreman as a four-square man, always on the level with them, will give any company better results and larger dividends. The morale of the foreman is usually reflected in the morale of the workingmen.

A foreman should be absolutely honest with his men in all things, so that he can expect the same of them. He should never make promises he is not absolutely certain he can fulfill, or dodge his responsibilities in any way. He should take the blame for the shortcomings and failures in his department and not shift it onto his men.

A foreman should always be able to explain fully and patiently any work required of an employee and if necessary do the work along with the men if it is something new or different than the usual practice. He should never ask an employee to do a dangerous job that he himself can't or won't do.

By inviting criticisms and discussion about handling new items of work or intricate pieces of machinery, interest is encouraged among the employees and valuable new ideas and inventions result.

A successful foreman is interested not only in the men he oversees, but in his co-workers as well in other departments. By taking time to talk things over with other foremen and workers he is often able to avoid petty altercations, gather much valuable information and co-operate with these departments for the benefit of the company.

Any company expects its foremen to watch its expenses as faithfully as they do their own. A foreman should teach his men to be careful with machinery, saving with materials and avoid wasting time. He should watch and discourage the reckless scrapping of materials that can be used again, and the abuse of company property.

The foreman should ever be on the alert to avoid any misunderstandings or misrepresentations between the company he works for and the employees. He should be able at all times to express the attitude of the men towards their company and vice-versa. He is afforded the opportunity of discouraging any undue agitation any one man or group of men may be spreading among the employees and he is also afforded the opportunity of standing by his men and getting better working conditions and equipment for them whenever possible. Truly the opportunities and responsibilities of a wide-awake foreman are unlimited.

* Submitted in the *Railway Mechanical Engineer* competition on the foreman's job.

Power brakes tested at Purdue

Satisfactory trainagraph developed—Impartial brake investigation now making rapid progress

THE American Railway Association is now making rapid progress in its investigation of power brakes and power brake operating appliances for freight trains on a 100-car test rack located at Purdue University, Lafayette, Ind. These tests, which are being carried out under a plan laid down by H. A. Johnson, director of research, were started November 30, 1925, and will continue until all power brake equipment under consideration have been tested. After experiencing considerable difficulty satisfactory trainagraph instruments which practically eliminate the human element in recording original data have been developed and the Type K triple valve tests are about 70 per cent completed.

In making the tests, the director of research was instructed by the Committee on Safety Appliances of the Mechanical Division to proceed upon the following plan:

1. Steps will be taken to obtain appliances, which, it is claimed, meet the views of the Interstate Commerce Commission, as indicated in its preliminary report and conclusions. If the plans or specifications for such appliances are available and the appliances are not yet being manufactured, steps will be taken by the director of research to secure such appliances, even to the extent of entering into an agreement to have such appliances made.
2. As soon as such appliances have been obtained they will be given exhaustive tests on the test rack at Purdue University, which rack will be completely prepared and brought up to date for the purpose of this investigation.
3. Following the completion of the rack tests such devices will be given road tests, to develop whether or not they meet road conditions safely in service.
4. This program will be carried out with all dispatch and as promptly as the devices for these tests are available.
5. The investigation will also embrace such further study as may, in the judgment of the director of research, throw further light upon this problem.

Progress of the work

In accordance with the above plan, inquiries were addressed to the air brake manufacturers to ascertain if they would design and build air brake equipments which would meet the views of the Interstate Commerce Commission. In response to these inquiries two air brake manufacturers, the Automatic Straight Air Brake Company and the Westinghouse Air Brake Company, agreed to furnish such equipments, and in February, 1925, the American Railway Association placed an order with each of these companies for 150 sets of freight train air brake equipments for trial purposes. The Westinghouse Air Brake Company will also submit a second air brake equipment embodying its views as to the desirable functions of an air brake equipment for modern freight train operation.

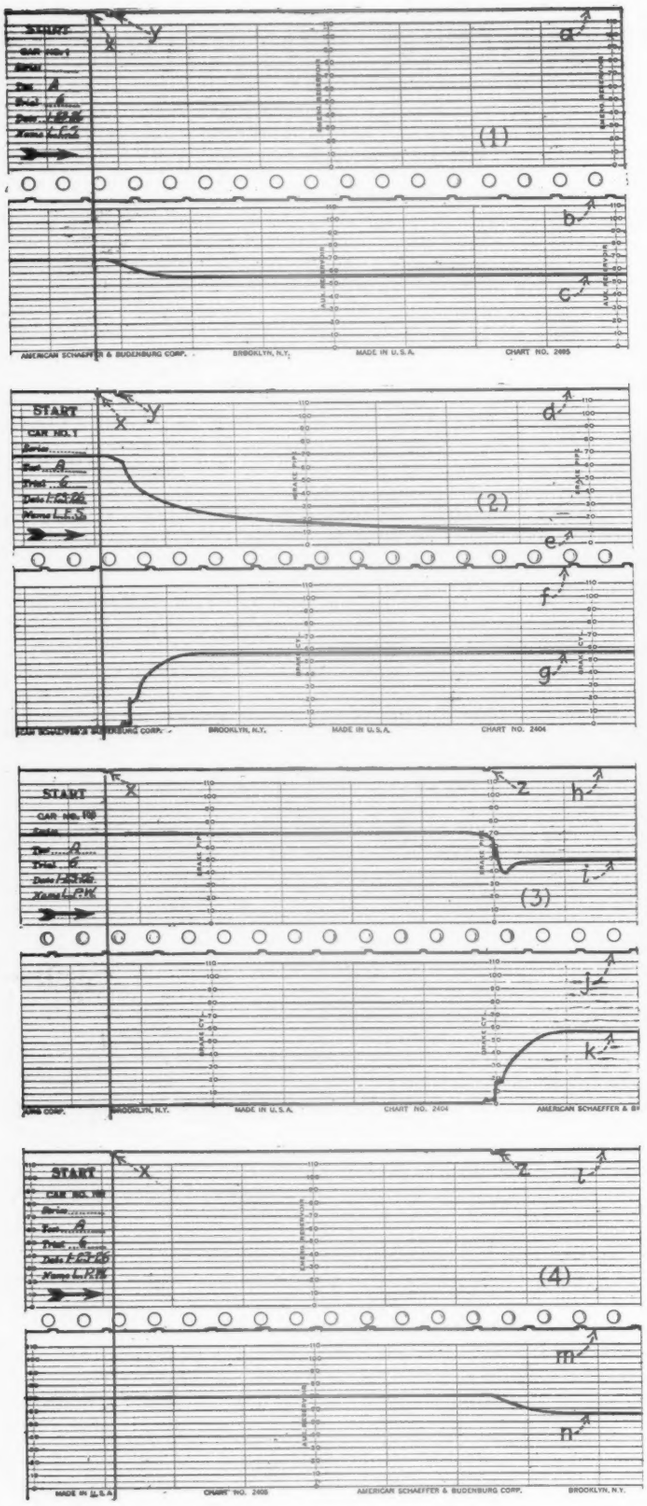
Ever since the orders have been placed, the manufacturers have been busily engaged in designing and building the equipments which they intend to submit. Up to the present time neither of the manufacturers has submitted its apparatus. It is anticipated that the Automatic Straight Air Brake Company will be ready to ship its equipment during the month of February 1926, and that the Westinghouse Air Brake Company will ship its equipment shortly thereafter.

The center aisle of the car rack with the locomotive equipment at the end of the aisle—This shows the brake pipe above with the hose connections between cars, the brake cylinders and yokes and oak blocks for obtaining the various lengths of piston travel—Car equipments from No. 1 to 50 are shown on the right and from No. 51 to 100 on the left

In the meantime the test rack has been completely rebuilt, the new recording instruments designed and installed, a basic schedule of tests developed and agreed upon by the various parties concerned in the investigation and tests started.

It was decided to make the same tests with the present standard air brake equipment for freight trains, known as Westinghouse Type K, as will be made with the new equipments, in order

1. To obtain accurate information concerning the functioning of this equipment,
2. To establish its advantages and short-comings,
3. To obtain a basis with which the new equipments will be compared so as to determine whether such new



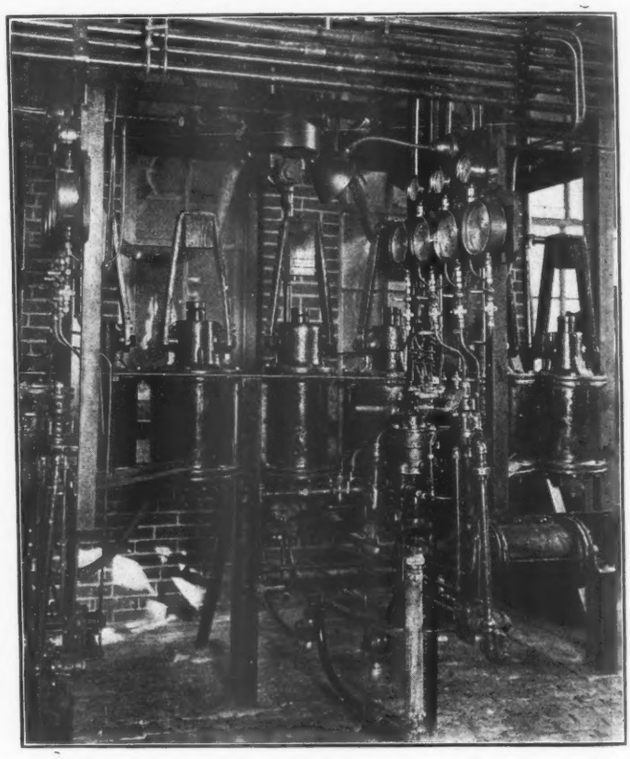
Record of brake action in emergency application on cars Nos. 1 and 100 with Westinghouse Type K 10-in. freight equipments on the Purdue test rack

Trainagraph charts (1) and (2) record brake action on car No. 1. Charts (3) and (4) record brake action on car No. 100. Reference letters a, d, h and e are event lines; b, f, j and m are time lines, with the distance between each notch representing one second; c, e and g are the auxiliary reservoir, brake pipe and brake cylinder pressures respectively on car No. 1; i, k, and n are the brake pipe, brake cylinder and auxiliary reservoir pressures, respectively, on car No. 100. Points x indicate brake valve movement; points y, initial piston movement on car No. 1, and points z initial piston movement on car No. 100.

equipments represent sufficient progress in the art of train braking to warrant their adoption.

Preparing test rack for the investigation

The American Railway Association air brake test rack is located in a separate building approximately 35 ft. wide by 100 ft. long adjacent to the testing laboratories at Purdue University. It consists of two main parts, the locomotive rack and the car rack. It was necessary to dismantle the locomotive rack and move it to a new location in order to provide more space for the new sections of the car rack. The old locomotive equipments were replaced with two new type No. 6-ET locomotive brake equipments, which are so installed that one or both locomotives may be used in the tests. Two new 8½-in., 150 cubic ft. cross compound air compressors were installed near the loco-



Part of the new locomotive racks; the automatic and independent brake valves of locomotive No. 2, are shown; also the locomotive and tender brake cylinder gages, vent valve and piping

motive rack and were so piped that either or both compressors could be used.

The old car rack, of sufficient size to accommodate 100 type K brake equipments, was not large enough for the new brake equipments which are to be tested. It was necessary to add four new sections to the car rack, and equipments were arranged so that there would be five brake equipments in each section. During this rearrangement of equipments, all piping was taken off the rack, hammer tested, blown out, replaced on the rack and blown out again. All brake cylinders were taken off the rack, cleaned, checked for wear, new packing cups installed and cylinders re-lubricated. All reservoirs were blown out and checked for leaks. The length of brake pipe per car was increased from 42 ft. to 50 ft., since the latter figure represents present day conditions in freight equipment. All hose and gaskets were replaced with new material. In other words, the entire rack was given a complete overhauling.

A new recording trainagraph was developed for this investigation. Each trainagraph is driven by a 110-volt, 60-cycle alternating current synchronous motor, so that all trainagraphs operate at the same speed. Each instrument has four pressure pens and four time pens. The four pressure pens automatically record the pressures in the brake pipe, brake cylinder, auxiliary and emergency reservoirs. Two of the time pens are electrically connected to a master clock and automatically indicate seconds on the charts, while the other two pens indicate on each chart the movement of the brake valve handle either to the service position or release position, which

(Right to left) H. A. Johnson, director of research, A. R. A., Professor Harry Robenkoenig, Purdue University, W. S. Helmer, engineer power brake investigation, A. R. A., and Professor G. A. Young, head of the school of mechanical engineering, Purdue University, shown adjusting a group of car trainagraphs. In the instrument in the foreground, the alternating current synchronous motor, the two charts, gages and copper pipe connection can be plainly seen

ever is desired. Since the brake valve event occurs at the same instant on all instruments, means are hereby provided for synchronizing all charts to a common starting point, the movement of the brake valve to the operative position.

For example, on the trainagraph charts illustrated, which show brake action in emergency application on cars No. 1 and 100 with Westinghouse type K, 10-in. freight equipments on the test rack, the four points *x* all on the same vertical line show the point of brake valve movement on each chart. Points *y*, indicating the initial piston movement on car No. 1 occur .4 second later than the brake valve movement. The gradual reduction of auxiliary reservoir pressure to 57 lb. is shown on line *c*. Brake pipe pressure drops more rapidly to a low point of 10 lb. as indicated by line *e*. Brake cylinder pressure builds up almost instantaneously with the first injection of air from the brake pipe and then more gradually as it

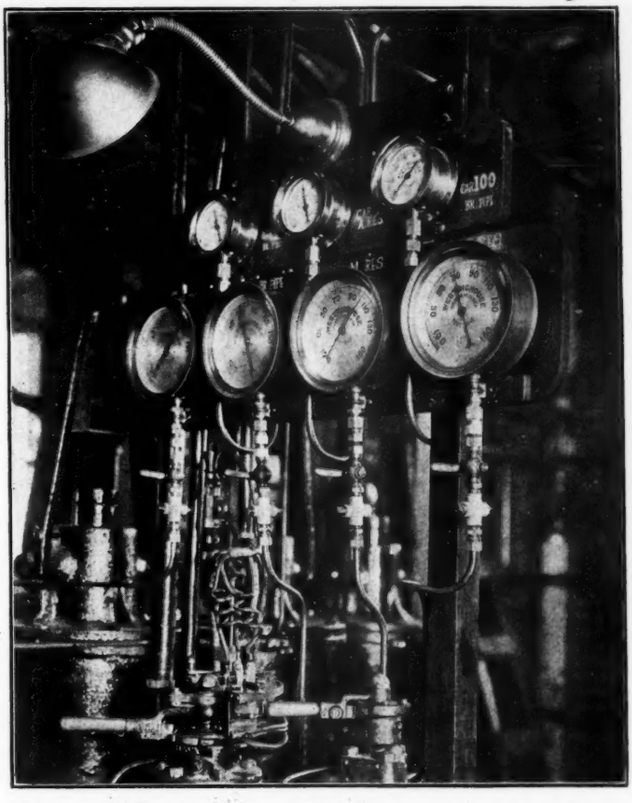
Five gauges have been installed at each car equipped equalizes with the auxiliary reservoir pressure at 57 lb. Points *z* indicating the initial piston movement on car No. 100 are observed from the chart to occur 7.1 seconds after the movement of the brake valve handle or, in other words, the brake on car No. 100 sets 6.7 seconds after the brake on car No. 1 sets. The variation in brake pipe, brake cylinder and auxiliary reservoir air pressures on car No. 100 can be accurately determined from an examination of lines *i*, *k* and *n*.

On eight cars distributed throughout the 100 car train the brake cylinders are equipped with circuit breakers so arranged that the electrical circuit is momentarily broken when the brake cylinder piston starts to move to application position and is again momentarily interrupted when the piston returns to release position. The operation of each of these circuit breakers makes an indication on the record chart for its respective car of the exact instant its brake cylinder piston started to apply and again when it returns to the release position.

A special locomotive trainagraph instrument was also developed to show at all times the position of the brake valve handle. This instrument also automatically records the pressures in the main reservoir and equalizing reservoir of the locomotive and the brake valve event as explained above for the car trainagraphs.

Thirty-four car trainagraphs and two locomotive trainagraphs have been built and have been installed on the test rack.

Five gages have been installed at each car equipped with a trainagraph for the purpose of checking the pressures shown by the instrument. All gages and train-



Close-up of the gages at the brake valve operator's position—The special electric wiring for recording the movement of the brake valve handle can be seen on the upper part of the automatic brake valve

agraphs have been calibrated and calibration curves prepared.

Mercury manometers were built and installed on cars No. 50 and 100 for the purpose of accurately measuring the brake pipe pressure at these cars in pounds per square inch and tenths thereof.

Three large storage batteries furnish direct current at 6 volts, 12 volts and 24 volts needed for the operation of the trainagraphs and the 110 volt alternating current is furnished by the University power plant. A very extensive system of electric circuits was installed on the car

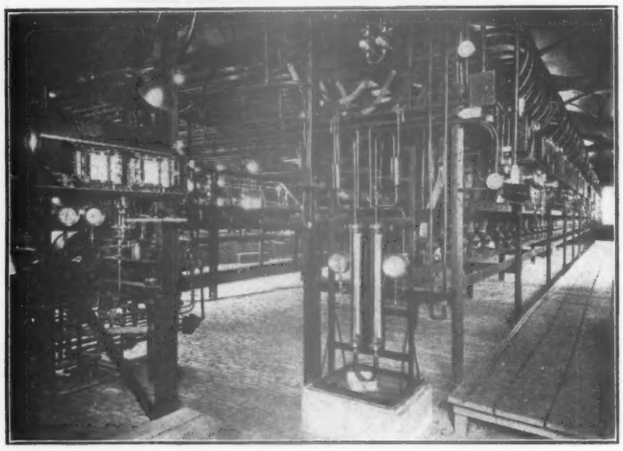
rack not only for lighting, but also for operating the trainagraph motors, the time and event pens and a trainagraph operator signal system. All of this wiring was installed in metallic conduit with approved switches and outlet boxes.

After all the piping and equipment had been installed, the brake pipe leakage for the 100-car train was reduced to less than 2 lb. per min. The leakage of each brake cylinder was also reduced to less than 2 lb. per min. In certain tests, however, artificial brake pipe leakage of 7 lb. per min. and artificial brake cylinder leakages of 5 lb., 12 lb., and 17 lb. per min. will be created by means of fixed orifices.

The basic schedule of tests

The first draft of the basic schedule of tests was sent to the following parties, who are concerned in this investigation, in the month of July, 1925.

W. P. Borland, director of the Bureau of Safety, Interstate Commerce Commission, Washington, D. C.; H. I. Miller, vice-president and general manager, Automatic



At the extreme left is shown one of the special locomotive trainagraphs, which is similar in appearance to the car trainagraphs—In the center foreground can be seen the mecury manometer at car No. 100—At the extreme right a good view is obtained of the instruments and equipments on cars No. 51 to 100

Straight Air Brake Co., New York, N. Y.; C. C. Farmer, director of engineering, Westinghouse Air Brake Company, Pittsburgh, Pa.; C. E. Chambers, chairman, Committee on Safety Appliances, Mechanical Division, American Railway Association; and V. R. Hawthorne, secretary, Mechanical Division, American Railway Association, for transmittal to the members of Committee on Brakes and Brake Equipment. Shortly thereafter conferences were held with each of these parties to ascertain their criticisms and suggestions for new tests.

After all of these suggestions had been included in the second draft of the basic schedule of tests, it was again sent out in October, 1925, to the parties referred to above for further criticisms, suggestions or approval. This draft was approved with some suggestions for additional tests. The basic schedule of tests is divided into the following main headings:

1.—Individual triple valve tests. (Single car.)
2.—100-Car train—level road conditions,—direct release.
3.—100-Car train—grade conditions—graduated release or retainers.
4.—50-Car train—grade conditions—graduated release or retainers.

The basic schedule of tests contains 565 separate tests which is indicative of the scope and extensiveness of this investigation. All equipments under consideration will be run through each test in this schedule. A large number of the tests in this schedule have been designed to reproduce conditions which are met in actual freight train service. The making of these tests in the research laboratory will result in the shortening of the time required to make the road tests.

The following freight train equipments will be tested on the rack.

1. Standard type K triple valves in order to determine the exact functions of present standard brakes for a basis of comparison with the new brake systems which will be tested.
2. Type K triple valves with heavier-than-standard graduating springs to determine the effect of these springs upon the functioning of the K triple valves.
3. Automatic Straight Air Brake equipment.
4. Mixed equipments of standard type K triple valves and Automatic Straight Air Brake equipments.
5. New Westinghouse air brake equipments, which, in this company's opinion, meet the views of the Interstate Commerce Commission.
6. Mixed equipments of standard type K triple valves and new Westinghouse equipments.
7. A second new Westinghouse equipment embodying this company's views as to the desirable functions of an air brake equipment for modern freight train operation.
8. Mixed equipments of standard type K triple valves and the second new Westinghouse equipments.

Personnel of rack tests—completion

An organization of trained men has been built up to carry on the test work. This organization at the present time consists of thirty men, all of whom have been especially picked out for this work. No University students are being employed. The testing is being carried on continuously working 44 hours per week. While one force of men are making tests on the rack, another force of men are compiling the results from the records made in the research laboratory.

Representatives of the Interstate Commerce Commission are present in the research laboratory at all times during the conduct of the tests. The air brake manufacturers have been invited to send representatives to be present not only during the testing of their own equipment, but also during the testing of the other brake equipments under consideration.

From the time being taken to test out the equipments under the first and second series, namely, the standard type K brake equipments and the type K brake equipments with the heavier-than-standard graduating springs, an estimate of approximately two months per equipment can be made. At this rate it will take practically all of the year of 1926 to complete the rack tests. Methods for reducing the time required to test an equipment are now under consideration.

"News as is news" is the heading of a bulletin which has been issued by the safety department of the Philadelphia division of the Pennsylvania, announcing the fact that the maintenance of equipment department on that division "has established a wonderful record" during the year 1925. Sixteen shops or departments reported no accidents, and ten shops or departments reported one accident each. During the last half of the year three shops in the Harrisburg district showed decreases, as compared with the same period of 1924, as follows: Maclay Street (1,936 employees), 120 accidents last year, 76 this year; decrease, 37 per cent. Lucknow (557 employees), 28 accidents last year, 11 this year; decrease, 60 per cent. Enola (1,822 employees), 210 accidents last year, 42 this year; decrease, 80 per cent.

The scoffer is exhorted "to go and do likewise; *it can be done.*" And the final appeal, at the bottom of the page, is—

DOES THIS MEAN ANYTHING TO YOU?

Standardizing apprentice training

A reason advanced for the comparatively slow extension of modern apprenticeship methods

By C. Y. Thomas
Supervisor of apprentices, Kansas City Southern

THE benefits of a thorough system of railway shop apprentice training have been widely discussed and the establishment of such a system advocated in the technical publications and before the American Railway Association by the leading mechanical men in the country, but the unusually slow extension of this work indicates that there must be some distinct causes for the apathetic attitude towards it. If apprentice training is good for one railway then it must have the qualities of being beneficial to all.

Hard to show tangible results

The main difficulty in starting a system of school and shop instruction for apprentices is that its value is rather intangible, making it a perplexing problem to show in "black and white" that education is an asset and worth capitalizing, or that the money expended in this direction will be returned in savings of time and material. The outlay for opening a school and providing a competent instructor is a large item and demands attention because of the fact that the school work must be kept on a high plane, abreast of the times, and at a reasonably low cost to attract the attention of mechanical officers.

Textbooks should be standardized

Railroading, after all, is much the same the country over; a blueprint in Maine may be read in California and a speed and feed problem in Minnesota is met with in Louisiana. The two main subjects of school instruction are mechanical drawing with its allied blueprint work, and mathematics. Yet in teaching the fundamentals of these subjects, it is strange to note that no two systems of schools use the same mathematics textbook. Exponents of apprentice training agree that there is no textbook published which covers the applications of the railroad field as they believe they should be covered. Also there is a divergence of opinion regarding mechanical drawing; no suitable textbook has been found. The cost of each road working up its own texts is considerable, whether typed, printed or blueprinted, and it is difficult to understand why a standard set of texts has not been worked up and adopted by all in the interests of economy.

If supervisors of apprentices cannot agree on the fundamentals of apprentice training, it is reasonable for others to consider the work in an experimental stage, unsettled and lacking in worth and stability. It is stated that conditions on one road differ from those on another and yet for the most part of the apprentice school work, the subjects are essentially the same and should be standardized.

Three-fourths of school work can be standardized

Standardization of apprentice school work could be achieved to the extent of three-fourths of the work given in the school, allowing one-fourth of the time for subjects peculiar to the individual road, such as studying the road's locomotive folio or locomotive and car inspection rules where they differ from those established by federal rulings.

As a basis for standardizing school work, the subjects which could be most readily worked out are mechanical drawing, blueprint reading, mathematics, valve gears, shoes and wedges, safety appliances, interchange rules, etc. The great value of these standards would be that men changing from one road to another would be better prepared. The value of standardization which would appeal most to the higher authorities would be that of lower costs of starting and maintaining the apprentice schools.

Those roads which do not have apprentice schools would find it far easier to establish them if they could start right in at a minimum of expense with a school curriculum already three-fourths worked out; they could profit from the experience of other roads which had mapped out the best possible range and handling of subjects.

Standardization can be further carried out by the adoption of standard school equipment, such as T-squares, triangles, instruments, drawing boards, paper, etc. The larger volume of purchases would appreciably lessen costs.

Some trades badly neglected

Standardization is always opposed by those who fear to lose individual distinction, yet the abandonment of this selfish idea in favor of co-operation will result in placing the work on a higher and more useful standard. The trades which are numerically the largest have been receiving the most attention in school work and the criticism which may be rightfully directed at the present school systems is the tendency to minimize the trades which have few apprentices and not give school work particularly suited to their individual needs. In this group may be classed the trades of electrician, blacksmith, upholsterer, pattern maker, painter and coach carpenter. Some apprentice schools are gradually working up courses for these but it stands to reason that the co-operation of all would speed up the process.

Need of organized effort

The primary difficulty in working up the standard texts would be the lack of organization. The total number of apprentice instructors and supervisors of apprentices in this country probably totals about two hundred. They are generally staff men. If they are too widely scattered to have an organization of their own, then it would seem entirely in order for the A. R. A. through Division V to have a committee on this subject, which can work out standards, make revisions and thus make available to all the very much worthwhile benefits of apprenticeship.

AN INTERNATIONAL ORGANIZATION which aims to serve as a meeting ground for unionized railway employees has been functioning in Europe for the past several years. The organization is known as the International Transport Workers' Federation. Headquarters are at Amsterdam and railway unions representing practically all important European countries are affiliated; the only union on this continent included is the Canadian Brotherhood of Railroad Employees.

Examples of recent locomotives of the 4-6-2 type

Arranged in order of weight

Railroad	No. Pac.	A. T. & S. F.	Penn.	So. Pac.	U. S. R. A.	Can. Pac.	Sou.	B. & A.	D. L. & W.	Mo. Pac.	L. V.	Read.	L. & N.	A. C. L.	N. Y. C.	U. S. R. A.	M. & O.	M.-K.-T.
Road class or number	Q-6	3,400	K-4s	P-10	Heavy	2.322	6,684	590	1,189	6,624	K-6-B	G-2-SB	282	P-5-B	6,503	Light	261	409
Builder	Amer.	Bald.	R. R.	Bald.	A. & B.	Mont.	Amer.	Amer.	Amer.	Amer.	Amer.	Bald.	Amer.	Bald.	Amer.	A. & B.	Bald.	Lima
Ordered or built	1922	1924	1924	1923	1918	1923	1923	1924	1923	1924	1923	1924	1924	1924	1924	1918	1923	1922
Tractive force, engine, lb	41,900	40,900	44,470	43,660	43,900	42,500	47,500	42,900	43,100	44,000	41,500	44,200	40,700	43,100	32,200	40,700	40,700	40,750
Tractive force, booster, lb	10,500	.....	.....	.....	.....	.....	.....	9,700	.....	.....	10,400	.....	.....	.....	9,700	.....	.....	.....
Cylinder horsepower (Cole)	2,312	2,252	2,690	2,252	2,624	2,252	2,624	2,434	2,252	2,427	2,421	2,477	2,252	2,252	2,076	2,252	2,252	2,252
Speed m.p.h. at 1,000 ft. piston speed	46.55	46.55	51.0	43.75	50.32	44.63	46.55	47.82	44.03	46.55	49.1	47.2	46.55	44.03	54.2	46.55	46.55	46.55
Weight of engine, lb	322,000	312,040	309,140	307,300	306,000	300,500	299,000	298,000	297,500	295,500	291,000	288,120	284,000	280,610	278,000	277,000	274,640	273,000
Weight on drivers, lb	197,000	191,220	202,880	183,100	197,000	179,300	179,500	185,500	190,500	188,000	181,000	177,210	177,000	177,480	169,000	162,000	164,660	167,000
Weight on front truck, lb	60,500	63,030	52,880	61,200	49,000	61,300	59,500	53,500	52,000	49,500	50,100	51,170	52,500	50,800	53,000	57,000	54,580	56,000
Weight on trailing truck, lb	64,500	57,790	53,380	63,000	60,000	59,900	60,000	59,000	55,000	58,000	59,900	59,740	54,500	52,350	56,000	58,000	55,400	50,000
Weight of tender, lb	198,500	241,960	....	239,700	194,200	188,400	197,000	204,000	185,700	235,400	197,500	183,480	194,000	187,790	207,000	194,000	203,360	201,500
Wheel base, driving, ft. and in	13—2	13—8	13—10	13—0	14—0	13—2	13—0	13—8	13—0	13—0	13—8	13—10	13—0	13—0	13—8	13—0	13—0	13—0
Wheel base, engine, ft. and in	36—9	34—11	36—6	35—6	36—2	34—9	36—1	36—11	33—11	35—3	36—6	35—9	34—11	34—11	36—5	34—9	34—11	35—3
Wheel base, eng. and tender, ft. and in	71—6¼	72—1⅝	.....	77—3½	70—8½	67—1	71—7	71—11½	69—10½	74—10	72—2	71—10¾	70—7½	70—9½	71—2	68—7⅛	70—9	71—1¼
Cylinders, diameter and stroke, in	26x28	25x28	27x28	25x30	27x28	25x30	27x28	26x28	25x28	27x28	25x28	25x28	25x28	25x28	24x26	25x28	25x28	25x28
Driving wheels, diameter, in	73	73	80	73½	79	75	73	75	69	73	77	74	73	69	79	73	73	73
Steam pressure, lb	190	200	205	200	200	200	200	200	200	185	215	220	200	200	200	200	200	200
Fuel	Sub. bit.	Oil	Bit. coal	Oil	Bit. coal	Bit. coal	Bit. coal	Bit. coal	Bit. coal	Bit. coal	Bit. coal	Ant. coal	Bit. coal	Bit. coal	Bit. coal	Bit. coal	Bit. coal	Oil
Boiler, diameter, first ring, in	80	78	82⅛	78	78	78½	76⅝	81	76¼	76⅝	74	72	74⅜	76⅛	70⅝	.....	76	75⅛
Firebox, length, in	120⅛	114	126	120⅞	120⅛	111⅛	128⅛	108⅛	111⅜	114	120⅛	126¼	114⅛	114⅛	105⅜	114⅛	114⅛	115
Firebox, width, in	84¼	84	80	84	84¼	84⅜	84¼	90¾	75¼	84¼	90	108⅛	84¼	84¼	77¼	84¼	84¼	72
Tubes, no. and diameter, in	190—2¼	214—2¼	237—2¼	193—2¼	216—2¼	205—2¼	216—2¼	210—2¼	260—2	199—2	199—2¼	163—2¼	188—2¼	188—2¼	175—2¼	188—2¼	188—2¼	243—2
Flues, no. and diameter, in	42—5½	40—5½	40—5½	40—5½	40—5½	38—5½	40—5½	45—5½	36—5⅜	40—5⅜	40—5½	30—5½	36—5½	36—5½	32—5½	36—5½	36—5½	36—5⅜
Length over tube sheets, ft. and in	18—0	21—0	19—0	18—0	19—0	18—6	18—6	21—0	17—0	20—3	17—0	19—0	19—0	19—0	21—6	19—0	19—0	20—0
Grate area, sq. ft	70.3	66.8	69.3	70.5	70.8	65	70.5	67.8	58.1	66.8	75.3	95	66.8	66.7	56.6	66.7	66.7	57.5
Coal rate, lb. per sq. ft. grate per hr. (Cole)	107	110	126	104	120.5	112.5	121	117	126	118	105	85	109.5	110	119	110	110	127.5
Steam required per hr.—lb. (Cole)	48,100	46,840	55,950	46,840	54,600	46,840	54,600	50,600	46,840	50,500	50,400	51,500	46,840	46,840	43,200	46,840	46,840	46,840
Heat. surface, firebox, total, sq. ft	335	270	307	283	327	298	290	252	291	272	328	292	273	275	228	261	269	230
Heat. surface, tubes and flues, sq. ft	3,084	3,841	3,728	3,069	3,497	3,232	3,399	3,940	3,156	3,235	2,957	2,633	3,074	3,076	3,193	3,072	3,072	3,542
Heat. surface, total evap., sq. ft	3,419	4,111	4,035	3,352	3,824	3,530	3,689	4,192	3,447	3,507	3,285	2,925	3,347	3,351	3,421	3,333	3,341	3,772
Superheating surface, sq. ft	928	998	1,172	836	887	803	905	1,163	756	980	845	675	830	824	639	794	794	880
Comb. evap. and super. surface, sq. ft	4,347	5,109	5,207	4,188	4,711	4,333	4,594	5,355	4,203	4,487	4,130	3,600	4,177	4,175	4,060	4,127	4,135	4,652
Tender, water capacity, gal	10,000	12,000	9,000	12,000	10,000	9,600	10,000	10,000	10,000	12,000	10,500	9,000	10,000	10,000	10,800	10,000	10,000	10,000
Tender, fuel capacity, tons or gal	14	4,000	13	4,000	16	12	16	16	10	16	15	15	16	16	16½	16	16	4,000
Weight on drivers ÷ weight eng., per cent.	61.2	61.3	65.6	59.6	64.4	60.5	60.1	62.3	64.0	64.6	62.2	61.5	62.4	63.2	60.8	58.5	60.0	61.1
Weight of drivers ÷ tractive force	4.70	4.67	4.56	4.12	4.49	4.22	3.78	4.32	4.42	4.27	4.32	4.01	4.35	4.12	5.24	3.98	4.05	4.10
Weight of engine ÷ cylinder hp	139.2	138.6	114.8	136.4	116.5	113.75	113.9	122.3	132.0	121.8	120.2	116.4	126.0	124.6	134.0	123.0	121.9	121.2
Weight of engine ÷ comb. h. s	74.1	61.1	59.4	73.4	65.0	69.3	65.1	55.6	70.8	65.9	70.4	80.1	68.0	67.2	68.5	67.1	66.4	58.7
Comb. heat. surface ÷ cylinder hp	1.88	2.27	1.93	1.86	1.79	1.94	1.75	2.20	1.86	1.85	1.70	1.45	1.85	1.85	1.96	1.83	1.48	1.67
Tract. force ÷ comb. heating surface	9.64	8.01	8.54	10.42	9.32	9.78	10.23	8.01	10.25	9.81	10.05	12.28	9.75	10.32	7.94	9.88	9.85	8.76
Tract. force × dia. drivers ÷ comb. h. s	704	584	683	766	737	734	755	601	708	716	774	909	712	713	627	720	709	640
Cylinder hp. ÷ grate area	32.9	33.7	38.8	32.0	37.1	34.6	37.2	35.9	38.8	36.3	32.2	26.1	33.7	33.8	36.7	33.8	33.8	39.2
Comb. heat. surface ÷ grate area	61.8	76.5	75.1	59.4	66.5	66.7	65.2	79.0	72.4	67.2	54.9	37.9	62.5	62.6	71.7	61.9	62.0	80.9
Firebox heat. surface ÷ grate area	4.76	4.04	4.43	4.01	4.61	4.58	4.11	3.70	5.01	4.07	4.36	3.07	4.08	4.13	4.03	3.92	4.03	4.00
Firebox surface, per cent evap. h. s	9.80	6.57	7.61	8.41	8.55	8.44	7.86	5.98	8.45	7.75	9.99	9.99	8.16	8.21	6.66	7.83	8.06	6.10
Superheat. surface, per cent evap. h. s	27.12	24.27	27.91	24.95	23.20	22.75	24.52	27.75	21.93	27.95	25.74	23.08	24.80	24.60	18.68	23.80	23.76	23.33
Notes	a-g	b-e	b	b-e	b	a	a	a-g	a	a-d-i	a-g	b	a	b	a-g	b	b	b

Key to notes: a—Boiler diam., inside; b—Boiler diam., outside; d—Syphon; g—Booster; i—Harter circulating plates.

Motive power developments on European roads*

High pressure locomotives with auxiliary low pressure steam turbine tenders may be expected

By W. H. Finley
Consulting engineer, Chicago

As much doubt exists in Europe regarding the type of major motive power that will eventually be developed as there is in the United States. Leaving out of consideration, for the present, small power units such as self-propelled motor cars, European opinion seems to be divided between the turbo- and the Diesel locomotive. With all the publicity that has been given these two types, I found no turbo-locomotive in commercial use in Europe and but one Diesel locomotive, the latter being in operation in Soviet Russia. This locomotive was built in Germany and has been in operation in Russia for some time. Its performance and record is being carefully watched by railroad men and manufacturers.

Diesel-electric unpopular—Only one turbo-locomotive in use

I was surprised to find that the consensus of opinion was against the practicability of the Diesel locomotive, electrically driven. Of the steam turbine developments under the Zoelly or Ljungstrom systems, outside of one or two experimental locomotives, the only one in actual use was the Ljungstrom steam turbine locomotive in Sweden. This locomotive is held at Stockholm on the Swedish State Railways for experimental and demonstration purposes, although it is occasionally used for special runs when there is a shortage of other power. The Ljungstrom company has had built and delivered to the Argentine a steam turbine locomotive which was received in the latter country in November and was expected to be in active service by this time. This locomotive, as expected, shows some improvements over the first experimental effort.

Beyer, Peacock & Company, Ltd., Manchester, England, is building a turbo-locomotive under the Ljungstrom patents, expected to be completed by this date and given its initial test on the London, Scottish & Midland Railway on the run from London to Glasgow. I was advised by an officer of the builders that this company has under consideration the development of a Diesel locomotive and will be prepared to furnish either type.

At the works of Henschel & Sohn, Cassel, Germany, I saw the testing in the yards of a 400-hp. Diesel locomotive, using solid injection and equipped with a Lentz gear transmission. While admitting that the present type of design is limited to slow speed of both driving and driven shafts and a limited range of speed of the driven shaft as well, belief was expressed that it could be so modified as to admit both high speeds and a wider range. The mechanical efficiency was given as 80 per cent. If this 400-hp. Diesel locomotive with the Lentz transmission works out satisfactorily, Henschel & Sohn expects to build a 1,000-hp. machine of the same type. Final decision will depend on the further reports of the operation of the Russian 1,000-hp. Diesel electric locomotive. Electric transmission was not regarded favorably by this company on the ground that it was too expensive (first and last), heavy, bulky, and too complicated. Their opinion is that the Diesel locomotive (provided that the transmisison can be solved) will be in limited demand for (a) intermittent yard switching and where there is a penalty against smoke and dirt, and (b) on branch and main line work of railroads in localities where water is scarce—where cheap oil fuel is available—and where coal prices are high.

Turbo-condensing tender being developed

Henschel & Sohn is now developing and building a turbo-condensing locomotive tender for coupling to a 1,200-hp. piston locomotive. The tender will contain a low pressure turbine with drive and condenser, thereby adding approximately 600 hp. to the drawbar pull of the locomotive without the expenditure of additional fuel. The oil in the exhaust steam from the reciprocating engine will be extracted to the extent of about 95 per cent. A favorable result is anticipated as a water cooled surface condenser is less affected by oil than an air cooled type. This company has also completed plans for a 2,000-hp. Zoelly type turbo-locomotive, featuring boiler, turbine with drive, and condenser on one frame. If this turbo-condensing tender proves successful the builder will proceed with a 2,000-hp. rigid wheel base locomotive and low pressure tender.

At the Krupp plant at Essen, Germany, I looked over the Krupp-Zoelly turbine locomotive that had been completed and had made some test runs on the German State Railways. This locomotive is a decided improvement over the experimental Zoelly turbine locomotive at the plant of Escher Wyss & Company, Zurich, Switzerland. It must be remembered, however, that the experimental locomotive at the Swiss plant was a converted steam locomotive and, in building the Krupp-Zoelly machine, a better arranged and more symmetrical looking unit was produced. Krupp is giving special attention to the development of a Diesel locomotive and is building a 1,000-hp. locomotive type, featuring a gear drive with magnetic clutch. This company also has plans under way for a 2,000-hp. Diesel locomotive but is not pushing it, awaiting more information as to the performance of the 1,000-hp. Diesel locomotive in operation in Russia.

In all the places visited, I found a decided doubt in the minds of many as to the commercial success of the Diesel-electric engine now in use in Russia. Some were very emphatic in their opinion that it was not a success, claiming that troubles had developed and the electric transmission was one of the items causing the most concern.

There is no doubt that the introduction of a low com-

* Abstract of an address delivered before the Western Railway Club, Chicago, February 15, following a two months' trip through France, England, Switzerland, Germany and Sweden in which Mr. Finley, who was formerly president of the Chicago & North Western, called upon many European railroad men and prominent manufacturers in the equipment field.

Notes ..... Key to notes: a—Boiler diam., inside; b—Boiler diam., outside; d—Syphon; g—Booster; i—Harter circulating plates.

pression, solid injection engine has given the semi-Diesel quite a boost and as a result the steam advocates have awakened and are making great developments in the prime mover using steam. At the works of Henschel & Sohn, Cassel, previously referred to, I saw a converted steam locomotive from the German State Railways that generated steam at 90 atmospheres and used a working pressure of 60 atmospheres, or 900 lb. When I saw this locomotive it had just come in from a run on the German State Railways.

Insistent demand for self-propelled cars

The demand for a small self-propelled car is just as insistent in England and on the Continent as in America. In conversation with the chairman of the board of Beyer, Peacock & Company, Ltd., he stated that what England needed was some form of small efficient self-propelled railroad car to enable the railroads to compete with the steam and petrol buses and lorries used on the highways. In Germany I found the same condition and the railroads are developing both Diesel and steam power for motor car work. Cars of both types in actual use are about equally divided, with the Diesels averaging slightly higher in power. Larger power units of both types of cars are contemplated. The steam cars are coal fired and are reported as having the advantage over the Diesels in both first cost and operating cost. Some plans of these cars suggest the revival of the Ganz idea. I also understand that plans are being developed for a small (500-hp.) automatically coal fired locomotive which will be operated by one man.

The Swedish State Railways are going in rapidly for electrification and this fact is engaging the attention of their organization to the exclusion of many other things. The State Railways own and operate no internal combustion motor cars. At one time they had a 100-hp. Diesel car but it was too small for their purposes and therefore was disposed of. There are, however, some fifty Diesel-electric cars owned and operated by small private roads in Sweden which are reported as giving good service. The State Railways are now trying out a 300-hp. Diesel electric locomotive, reported as performing satisfactorily. The inspection of this car showed that its about 40 ft. in length and aside from an 8-ft. baggage space is all power plant. The engine was being overhauled at the time of inspection.

Railroads need secondary motive power

I feel that what the railroads need is a secondary power, something between their small standard locomotives and the light weight self-propelled cars. Whether such a car will take the form of the internal combustion engine or steam is still a matter to be determined. I feel that in cars of 500 hp. it will be possible to develop a steam car that will compare favorably in efficiency with the internal combustion type and would not require the building up of a special personnel for their maintenance. Steam has proved a very reliable source of power for railroad transportation owing to its flexibility.

Since Watt, over 100 years ago, called R. A. Trevithick a potential murderer for proposing to operate boilers at the dangerous pressure of 60 lb. per sq. in., every subsequent increase in steam pressure was opposed by the conservative majority, and it was not until our electrical friends demanded something more efficient in the way of high speed for their purposes than the existing steam engine as a prime mover, that the steam turbine was developed to meet this demand. The steam engineer, owing to established precedents, opposed higher speeds and high pressures. Electrical engineers, on the other hand, not being tied up to so long a line of precedents were more progressive and the steam people were forced to meet their demands. I think I still notice in this country among steam users, objection to high rotative speeds in turbines. European engineers seem to have pushed ahead of us in this respect.

The same feeling existed as far as the boiler was concerned and high pressures were looked at with alarm, but the increase in boiler pressure has gone on until now 500 lb. and more is accepted. We have now reached the point of giving serious consideration to the Benson super-pressure boiler. In this boiler it is proposed to generate steam at a pressure of 3,200 lb. at a temperature of 706 deg. F. An experimental plant has been constructed at Rugby, England, which it is expected will be in operation about the first of the year. A 50 per cent interest in the boiler has been disposed of to the firm of Siemans & Schuckert, German, and the latter company has erected a 2,000-kw. plant at Berlin for experimental purposes.

Regardless of whether the prime mover is a gasoline engine, Diesel motor, or steam turbine, it is very important that the transmisison between the prime mover and the secondary shaft be of such flexible character that it will not transmit shocks and jars from the track to the prime mover. This is so thoroughly recognized by railroad men and builders of locomotives and motor cars that probably more attention is being given it today than the type of prime mover. I found that they are not only building various kinds but any number of projects are in the air. Unfortunately many of them fail to get down to earth.

(Mr. Finley here described in some detail several of the important transmissions offered to date including hydraulic (swash plate, Lentz, and Fottinger); semi-hydraulic (Schneider hydro-planetary and Sim); and several miscellaneous transmissions including the Entz magnetic, Constantinesco torque converter and the De Lavaud which imparts its motion to the driven parts through ratchets or a variation.—Editor.)

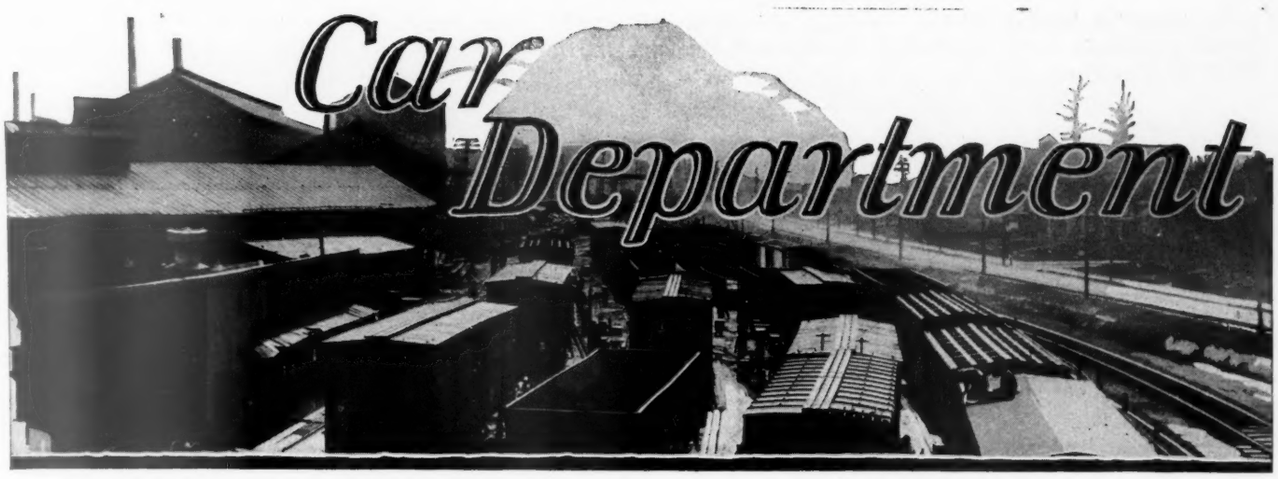
We have been told, from time to time, that the steam locomotive would be scrapped in favor of some new form of power, but it is still doing good and reliable work for the railroads, and will continue to do so for many years to come.

I believe, however, that improvements can and will be made that will greatly increase the value of the steam locomotive for transportation purposes. I believe that some of the power on the railroads can be greatly improved by the addition of a low pressure steam turbine tender, adding greatly to the tractive force without any additional fuel consumption and thereby making unnecessary the purchase of heavier power.

I believe the next improvement will be in the use of higher pressure steam and with a tender carrying a low pressure turbine, or possibly the combination in one unit of a high pressure piston locomotive and steam turbine. I believe these improvements will come in the immediate future.

Assuming that the Benson super-pressure boiler becomes a commercial success, I can vision the operation of railroad terminals, and even suburban trains by fireless locomotives with steam furnished from highly efficient super-pressure central stations, thus eliminating smoke, dirt and noise. This will save railroads the large expense that electrification would entail.

The Interstate Commerce Commission has denied a petition of the Louisville & Nashville that it be relieved of complying with the second automatic train control order of the commission until it has had time to determine the results of its first installation, but has postponed the effective date of the order from February 1 to July 18.



Methods of cleaning the interior of freight cars

SHIPPERS of grain, flour, sugar, rice, fruit, and food products of all kinds naturally demand cars that are free of all odors, and cars whose floors and walls are neither greasy nor oily. Even shippers of rough freight are becoming more and more particular as to the condition

Brushing out a car after it has been rinsed with water

of cars furnished them for loading. The advantage to be gained by the railroad that fully meets these demands is obvious.

Formerly, two general courses were followed in refitting greasy and smelly cars. Many such cars were refloored and fortunate has been the foreman who could report a hundred dollar average for each reconditioned car. Or in some cases, particularly those involving smelly cars, sulphur or lime or a combination of both has been used to combat the offensive condition. The two objections to this latter system are that frequently the smelly condition was not improved, and that where improvement was obtained, many days were required, which when figured into the cost of cleaning made this figure exhorbitant.

To remedy these conditions it was but natural that cleaning methods should swing to the other extreme, and in place of being too crude to be effective the methods next devised were too detailed to be efficient, and so much costly equipment was needed that the working costs were raised beyond the limits of economy.

Today, extremely greasy and smelly freight and refrigerator cars are cleaned in two to four man hours and immediately after drying are loaded with food products. The cost of doing this work totals but a few dollars per

The car has a cleanly, tidy appearance after the oil and grease have been removed

car, a $3.00 average being in no way unusual. Further, the equipment necessary for such work is neither costly nor extensive as it includes a broom, a sprinkling can, two buckets, a hose line, a squeegee and two wire brushes.

The dirt to be removed from freight and refrigerator cars is of three kinds: general rubbish, oil and grease, and

those materials leaving odors. Ordinary sweeping and washing methods will satisfactorily remedy only the first of these conditions.

Methods of cleaning oily cars

Oily or greasy cars should first be swept dry throughout. Then, using an ordinary sprinkling can, apply a solution of a prepared metal cleaner, such as is used in the shops cleaning vats, to all oil or grease spots or, in very dirty cars, completely cover the floor. Let this solution stand about ten minutes, but do not allow it to dry out. Then scrub with wire brushes as shown in the accompanying illustration, and thoroughly rinse out the car, using a hose line if available.

The cleaned cars will dry out much faster if excess water is pushed out with a squeegee. After the car is dry the floor will be clean, free from grease, and immediately available for loading freight of any kind.

The cleaning solution used in washing oily and greasy cars is prepared in the following manner. Put from four to seven pounds of metal cleaner in an ordinary pail and add about three gallons of water. The exact amount of cleaner to be used depends upon the condition of the car to be cleaned. When available, some time will be saved by using hot water in making up the solution. When a

A refrigerator car with oil and grease on the floor

number of cars are to be cleaned it is advisable to make up in barrels 50 gal. of solution. The solution should be stirred each time before using.

As the average car can be cleaned with from four to seven pounds of metal cleaner, and as the cost of the cleaner is but a few cents a pound, material costs per car are very low. The class of labor doing this work probably is paid $.40 an hour, and since it is not unusual for two men to average eight or nine cars in a nine hour working day, labor costs are reasonable.

Method of removing odors

Cars with strong odors are cleaned in a somewhat similar manner, but using a sanitary cleaner instead of the metal cleaner used when washing oily and greasy cars. This is also an alkali but of different composition and of far less strength than metal cleaners. The principle on which it operates is not that of displacing one odor with another but of completely removing their cause, giving a sweet smelling, odorless condition.

Smelly cars should first be carefully swept dry, brushing down the walls and ceiling, and cleaning out all the crevices. Then thoroughly flush the car with water, and again sweep out. Where cars are equipped with floor racks these should be removed and cleaned separately. Cars equipped with ice bunkers should also receive special attention as the bunkers are frequently an ideal storage for bad odors.

While the car is still wet, sprinkle the interior with the dry sanitary cleaning material and let it stand for about ten minutes before scrubbing.

Then using a solution of one pound of the sanitary cleaner in a three gallon pail of water, scrub the interior of the car with brooms. Especial care should be given all corners and cracks. After scrubbing, rinse the car well and to hasten drying, push out the excess water with a squeegee. When the car is dry it will be found to be thoroughly clean and odorless, being immediately available for loading all kinds of food products.

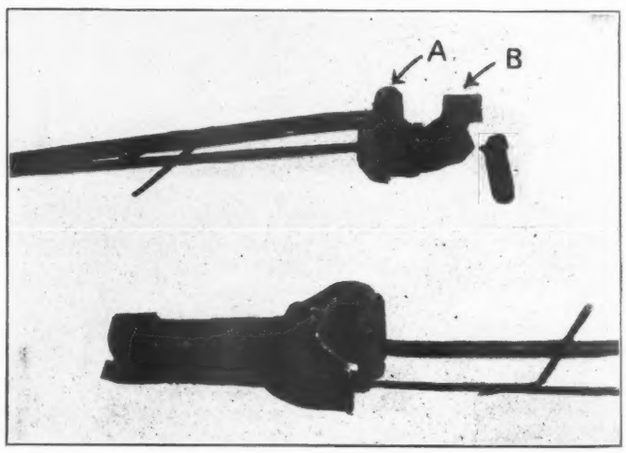
Where the cars are both greasy and smelly, first clean with the metal cleaner solution, and after rinsing, clean a second time with the sanitary cleaner and cleanser solution. Cars that are especially smelly should be cleaned with a somewhat stronger sanitary solution than outlined above, using three pounds of the sanitary cleaner instead of one in the scrubbing solution and also allow the dry powder to remain on the wet floor 15 or 20 min. before starting the scrubbing. Ordinarily smelly cars will require but 10 lb. of the sanitary cleaner, while especially bad cars may require from 15 to 20 lb.

Device for holding car couplers in a blacksmith's fire

By J. Robert Phelps

Apprentice instructor, A. T. & S. F. shops, San Bernardino, Cal.

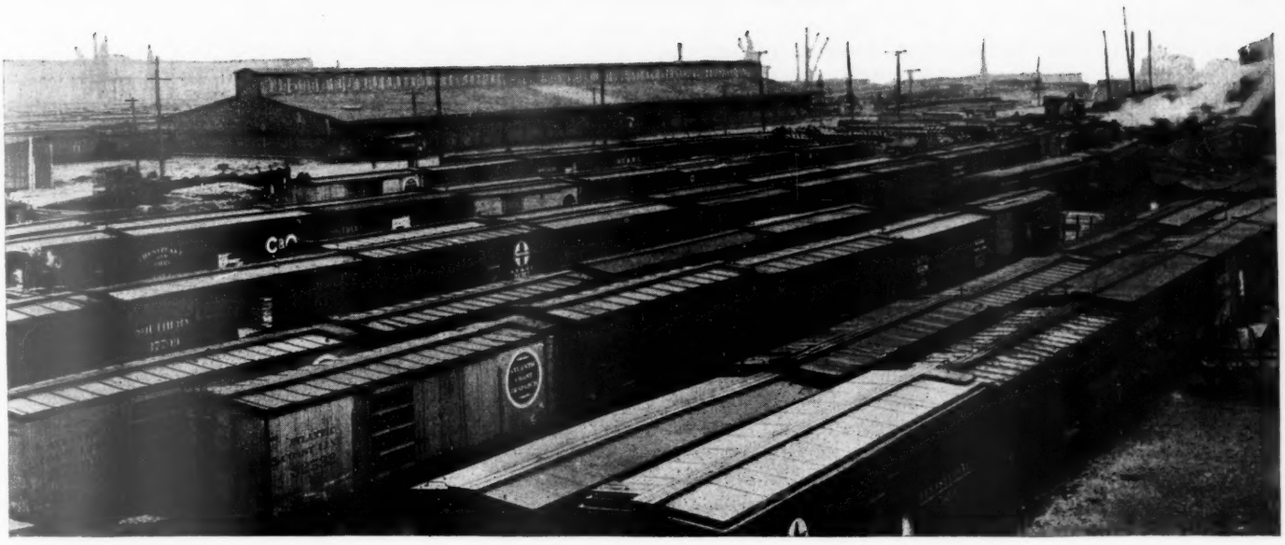
A CAR coupler is an awkward piece of work for a blacksmith to handle when straigntening it in a forge fire. The device, shown in the illustration, designed by J. Wyler, general blacksmith foreman, provides a means of handling couplers with comparative ease. A hole is drilled



The top view shows how the handle A and block B are welded to the knuckle; The lower view shows the knuckle in the coupler

in a coupler knuckle at point *A* in which is inserted an iron bar. An electric weld is placed around the bar where it enters the knuckle, the purpose of which is to prevent the bar from working out. A small iron block is welded on the coupler knuckle at point *B* to prevent it from opening when it is placed in the coupler.

When the blacksmith has a number of couplers to heat and straighten, he uses this knuckle in each coupler, holding it in place with a knuckle pin. A chain can be placed around the bar for supporting and balancing the coupler.



Systematic preparation of A. R. A. billing and records*

By Livingston Martin

Chief accountant, A. R. A. Bureau, B. & O., Baltimore, Md.

CAR repair billing, on account of the high cost of labor and material, has assumed such proportions in the maintenance of equipment costs that it is decidedly important that it be handled in a systematic manner with the least cost essential to full protection of the railroad companies, and the proper handling of this item will assist the management of the railroads in the reduction in operating expenses.

The American Railway Association Interchange Code of Rules is divided in three classes: interchange, maintenance and billing. The billing rules are so closely linked to the interchange and maintenance rules that it is not possible to obtain efficient billing without a thorough knowledge of all the rules; therefore, it is the duty of the billing bureau to check interchange and maintenance as well as billing.

In checking interchange, let me suggest that your traveling man periodically visit your large joint interchange points, check the repair records and take note of all the delivering line defects repaired and compare them with the joint interchange records to see who delivered the car and whether or not defect card was issued. In this way you will determine if your local people are making proper claims for protection. If you find they are not, test your foremen and inspectors to see if they are familiar with all delivering line defects and impress upon each individual the losses sustained by the company through improper protection at interchange points. The Joint Interchange Inspector will issue the defect cards whenever the necessary data and a chance to examine the condition is furnished him.

Small outlying interchange points can be checked in the same manner by visiting the nearest repair shop in line with the movement of traffic and comparing the repair and inspection records. Similarly, the operation of shops can be checked to determine if your supervision is running cars received in interchange with delivering line defects without making repairs by listing the defects from the interchange records and comparing them with the repair records.

Some joint interchange inspectors will not issue defect cards for many items of handling line defects unless it is shown that repairs were made and a check of the shop records on line will very often reveal the amount of losses sustained by the company in running cars with delivering line defects. Bear in mind, delivering line defects must be repaired before the car leaves your line and the company who runs cars away from interchange points or nearest shop thereto with delivering line defects that have not been carded pays double the cost of making the repairs later.

It is expensive practice to shop cars for repairs at any point and run them without making the repairs and if you will examine your inspection records at repair points and follow the movement of cars over your line, you will find this practice is being indulged in to some extent and cars are being shopped two or three times at different points for the same defects, until the condition becomes such that repairs must be made; in the meantime, the delay to shipment, switching and per diem costs has far exceeded the repair costs.

Issuing defect cards

From the manner in which a great many defect cards are issued, I do not believe that all inspectors realize the importance of correctly writing defect cards, or that they are issuing the equivalent to a check on the bank account.

It is not uncommon to receive defect cards in the bill-

*Abstract of paper presented before the twenty-fourth annual convention of the Chief Interchange Car Inspector's and Car Foremen's Association of America, held at Chicago, September 22, 23 and 24, 1925.

ing bureau with the station, date, location of defects, sometimes name of inspector, left off, defects jumbled up from end to end, to roof, to trucks, to sides, to ends, etc., indicating that the inspector kept walking around and climbing over the car until he finally got all the defects listed on the card and when finished, the defect card resembles a scrambled egg—you cannot distinguish the white from the yellow. It is the bill clerk's job to check the bills received on such cards and I believe you will readily understand how impossible it is for him to do so properly with information furnished in that manner.

Issue defect cards in a plain legible hand, written on both sides in accordance with the rules so that at least one side of the card will be legible when removed from the car and forwarded to the billing bureau, list all defects, particularly on specially constructed cars such as: refrigerator, chicken, tank, etc., for which the handling line is responsible, and eliminate, as far as possible, the necessity of bill clerk having to decide if additional items charged for, not shown on the defect card, were necessary to repair the items shown on defect card, segregate the damages as to location and show the location of defects on car in accordance with A. R. A. Rule 14, which will enable the bill clerk to see in his mind's eye the defects as they existed on car, and you will remove some of the items of grief that come into the bill clerk's daily life.

In order that the bill clerk may have an opportunity to correct irregularities in issuing defect cards, a copy of each card issued should be immediately forwarded to the billing bureau, which will enable him to call to attention any irregularities in issuing defect cards and at the same time educate the individuals in the proper issuing of cards. Receipt of copy of defect card also enables the billing bureau to check the location of the car through the car service department to see that defect cards are not erroneously issued against the company and permits them to make any special investigations, such as wrong wheels, without waiting for receipt of bill from repairing road.

Avoid making wrong repairs as far as possible by applying A. R. A. standard material and framing timbers to proper size, in accordance with the owner's standards and A. R. A. practices. For owner's protection, defect card must be attached to car at the time and place wrong repairs are made and for handling line protection the defect cards must be marked "labor only" when they involve material not listed in Rules 88 and 122. Making wrong repairs is expensive in that the bill you render is usually more than offset by the bill you receive for correcting wrong repairs.

With the exception of cast iron in place of steel wheels, wrong repairs are not cardable in interchange; however, interchange inspectors, as well as all other inspectors, should look for wrong repairs and attach joint evidence card to car, as joint evidence card is not valid unless signed within 90 days of first receipt of car on home line. Correction of wrong repairs must be made within nine months of first receipt to justify the bill on the defect card.

All other defect cards are outlawed two years from first receipt and they should be watched closely to see that repairs are not delayed beyond the two year period.

Original record of repairs

It is useless to say that the prescribed A. R. A. forms should be adopted as nearly as possible on all railroads. The Supplementary Regulations, effective January 1st, 1924, detail the manner in which these records must be compiled, as well as some of the information that must be shown, in order to collect for repairs made and if you are not following out those regulations in preparing your records, you are not complying with the A. R. A. rules.

It is desirable, from a shop operating standpoint, to inspect and write the original record of repairs as soon as cars are placed on shop tracks, as it furnishes a guide for the workmen and often saves time as it is not always possible for the foreman to be on hand to explain the work to be done as the men advance from one car to another.

The prescribed Form "F" shows the general minimum information that must be shown on the original record of repairs. In addition I believe the form should require the date the car was built, light weight, loaded or empty and kind of trucks, as these items often govern the charges to be made and aid in checking repair records. The date built also establishes the standard to the car in the case of triple valves and couplers.

It is also necessary that the party writing the original record determine the responsibility for repairs. Where a car has both the handling line and owner's defects, the repairs should be segregated under each heading. It should also be shown if temporary or wrong repairs were made and if defect card was issued. When repairs are made on authority of defect card, notation showing name of road and date card was issued should be made. The latter information is important in tracing for lost cards, as well as defending bills for handling line defects. It is my suggestion that above information and repairs be segregated on the original record under the headings: Owners Defects, Owners Defects—Wrong Repairs, Owners Defects—Temporary Repairs, Handling Line Defects, Handling Line Defects—Wrong Repairs, Handling Line Defects—Temporary Repairs, Authority of Defect Card.

Do not specify nuts used with removal of bolts, but any additional nuts not used with renewal of bolts should be entered on record as a separate item. Some roads use unit nuts in lieu of common nuts and these should be specified whether or not used in renewing of bolts. The kind, full dimensions or actual weight of castings, forgings, structural and pressed steel shapes must be shown on record. I favor reporting dimensions on all regular size material over actual weights furnished by the shop people, as I believe more uniformly correct charges will be made therefrom, besides it furnishes a basis for the party receiving bill to check weights. While the rules only require "new" or "second hand" shown for certain materials, I believe it good practice to show this information for all material, as it creates habit in showing kind.

The party making final check of the original record with repairs made to car should establish the following facts and complete the record before he attaches his signature:—

1—Are all repairs shown on the record properly made?
2—Were any additional repairs made that are not shown on record?
3—Show kind of material applied.
4—See that all other information required by the rules is properly shown.

The correct foundation for car repair billing, therefore, depends on your educational system and I believe better results can be obtained through personal contact than by any other method. I am not in favor of educating clerks at the repair points to relay the information to the man on the shop tracks. I am in favor of educating the men who write the original record and believe the responsibility for educating the men to prepare correct records should be placed on the traveling men, thus establishing a direct connection between the billing bureau and the men who write the records. For the purpose of keeping the traveling men posted as to conditions in their territory, let the billing bureau return all irregularities in records direct to the traveling men whose duty it is to call on the individual responsible for the irregularities and explain to him his error, and show him how the

record should be prepared, pointing out the specific rules governing the case, at the same time allow him to correct record in accordance with supplementary regulations. If you have a man who will not improve under this method of education, then you have not the right man on the job, and there is only one remedy, remove him. It is expensive to educate the men for work checker jobs, therefore, they should be kept on the job as far as possible, except when promoted. It has been said before in this meeting that a car foreman or car inspector who does not know the A. R. A. rules is an expensive man to the railroad and I want to add that the work checker who does not know the rules is also expensive; therefore, educate your work checker and in doing so you are building up an organization from which to select your future car foremen or other supervision.

In accordance with supplementary regulations, the traveling men should make surprise checks on shop tracks for protection of both the owner and handling line, by arriving on the shop tracks at the closing hour and checking the original record with the repairs made to cars.

I am not in favor of having the traveling men spend their time in the office checking repair cards with original record, as I do not believe it pays financially, in fact, that class of check can be done with much cheaper labor, but I am in favor of the traveling men spending their time on the shop tracks and in the transportation yards, checking up the class of work performed as well as the records and assisting those doing the work and making records wherever possible.

I am not in favor of voluminous reports of each minor irregularity from the traveling men to the higher officials and which later come back with a jolt that destroys the good will of the shop forces, but I am in favor of the traveling man working out the conditions and correcting the irregularities on the ground and making his reports only when the local people will not improve under his instructions.

Hold the traveling men responsible for the conditions and you have a positive check in your building bureau on the condition, in the number of records you are compelled to return for correction.

The supplementary regulations state that no erasures are permitted on original records and corrections must be made by drawing a line through the wrong information and rewrite the correct information; however, I am not in favor of wholesale corrections for the reason that unless the car is still in the shop, with few exceptions, corrections are made from memory and are, therefore, classed as assumptions.

For the purpose of securing uniform records, the Baltimore and Ohio adopted a code of symbols for showing kind of material, cause for repairs and location of repairs, which are as follows:

A—Accident Rule 32.
B—Broken.
BA—Broken due to accident according to Rule 32.
BD—Broken due to decay.
BT—Bent.
BW—Broken and welded.
BU—Burst.
BS—Burst in seams.
D—Decayed.
L—Loose.
LK—Leaky.
M—Missing.
OP—Out of place.
ST—Stripped threads.
WO—Wornout.
NA—New material applied.
OA—Second hand material applied.
R&R—Removed and replaced same material.
RSR—Removed, straightened and replaced, same material.
S—Straightened.
SC—Straightened on car.
A—A end.
B—B end.
AL—A end, left side.
AR—A end, right side.
BL—B end, left side.
BR—B end, right side.

The above symbols, together with the regulations for originating original records as covered by supplementary regulations, are printed on the back of our original record forms and we require each individual to use them in preparing records, which insures a uniform record from all stations, saves time of the work checkers in writing records, insures full complete information in all cases, saves time of the clerks reading records and reduces to the minimum errors in rendering bills.

Get the foundation correct and all else is easy.

Handling accident cars

The determination of responsibility for repairs to extensive damages on foreign cars is of such importance that it should be especially handled by the supervision in the car department and billing bureau for the protection of both handling line and owners.

A. R. A. Rule 32 furnishes the dead line and any damages occurring under the provisions of that rule should be plainly marked on all records pertaining to car repairs. In case the two inspectors do not agree as to responsibility, the car foreman should render final decision.

Copies of all accident reports on the division should be forwarded to the car foreman and complete file maintained in the car foreman's office. I would suggest that the accident reports be filed in a loose leaf binder, properly indexed according to car numbers. In case accident cars are moved from one division to another for repairs, a copy of accident report should follow the cars. Before records or billing repair cards are forwarded to the billing bureau, they should be compared with the accident file to guard against improper charges. In case the division people subsequently learn of any errors in marking responsibility on records or repair cards, they should immediately notify the billing bureau to make adjustment.

As a further precaution against charging for accident repairs, the wreck master should forward a copy of all accident reports direct to the billing bureau, who should check with the bill files and make adjustment in all cases of erroneous billing.

Where accident reports do not show sufficient detail to properly determine responsibility for repairs, it is the duty of the billing bureau to thoroughly investigate the conditions surrounding the failure before rendering bill and place the responsibility accordingly.

Many roads use the accident forms in reporting disciplinary cases to the transportation officers and where this is done, diligence on the part of the billing forces is necessary to see that charges are not marked "accident" where the damages do not occur in accordance with the provision of Rule 32.

Handling of destroyed cars is another item that should receive the personal attention of the supervision as it is an easy matter to throw away $500 or $1,000 on a car through not handling it according to the provisions of A. R. A. Rules 43 and 120.

The A. R. A. rules do not place any limit on the owner's responsibility so long as the damages are not caused by any of the provisions of Rule 32, therefore, carefully prepared estimated costs of repairs, per A. R. A. prices, should be made on all extensively damaged cars to determine the most economical disposition to be made. Very often accident cars can be repaired and restored to service at considerable less cost than the depreciated value. Only such cars as are damaged under the provisions of Rule 32, or on which you are unable to furnish statement as per Rule 43, should be handled under Rule 112. I am afraid that a great many carmen are overzealous in getting rid of damaged cars and destroy them under Rule 112 without giving the owner an opportunity to inspect them in accordance with Rule 120, with the

result that the handling line pays depreciated value on owner's defects when they should be reimbursed for labor cost of dismantling car.

When estimating the cost of repairs be sure that all items are fully covered according to A. R. A. prices, as bills for repairs will be accepted for only $50 in excess of the estimate. For the purpose of securing correct estimates, the shop people should list in detail, all damages in the same manner they prepare records for billing. The estimate should be priced and completed by the billing force.

Handling of transfer and adjustment and door protection bills

As a general proposition, this item is not being hantend that it has no connection with the Interchange Rules dled by the car repair billing forces. Some roads conand should be handled by the transportation forces under the Accounting Officers' Association Rules. In this, I do not agree for the following reasons:

1—It is authorized by Interchange Rule 2 and Car Service Rule 14, whicl is made a part of Interchange Rules.
2—The work in the large majority of cases is performed by car department employes who furnish the information for billing.
3—Supplementary regulations recommend that all matters pertaining to Interchange Rules be handled by the billing bureau.

On account of the billing bureau's familiarity with the rules as well as road conditions, I favor the handling of transfer and adjustment bills by the billing bureau and believe that considerable savings can be made by handling them in that bureau, particularly if the bureau is equipped with traveling men through which to make investigations.

As far as checking debit bills for this work is concerned, there is not much that can be done as they are rendered on the actual cost basis, however, your home records should be investigated to see that all costs entering into this work are billed for.

Copy of each authority issued for transfer and adjustment of lading should be forwarded to the billing bureau for investigation as to movements of car. You will find many authorities issued account of old defects, where the car service records show the cars coming from connections, indicating that the inspection at connections is lax.

In other cases you will find bad order cars loaded on home line. All such cases should be taken up with the proper operating officials as the greatest saving to be had in handling this item is to prevent the necessity of transfer and eliminate freight claims.

The item of inside door protection should be handled in the same manner with a view of having the shippers properly load cars in accordance with loading rules before accepting them for movement.

The importance of systematic methods

The most important factor in handling any business is system and you will pardon me for referring to my personal experience with three different systems for handling car repair bills, as I feel that some benefit may be derived therefrom by the members of this organization in improving the systems on their respective roads.

Under the first system, the complete bill was rendered at the repair station; that is, the billing repair cards were written, priced and listed on bill forms and the complete bill was forwarded to central office where they were consolidated under one recap. and forwarded to the various railroads.

The principal objections to this system, outside of its high cost, was lack of uniformity in charges as it was practically impossible to keep highly trained price clerks on jobs scattered over thousands of miles, lack of supervision, account of which many heavy repair charges which the clerks did not know how to price, found their way to the waste basket, endless correspondence with the division people, as all records were filed at repair stations and with railroads in adjusting errors in bills. Under this system, the Baltimore & Ohio ran a monthly debit account in foreign car repairs of from fifty to one hundred thousand dollars.

Under the second system, the billing repair cards were written at repair points and forwarded to the central bureau weekly where they were assorted for ownership, priced and listed on bill forms to railroads. This system eliminated the necessity of maintaining price clerks at repair stations and made possible uniform charges and credits in rendering bills and reduced to the minimum wilful destruction of bills, but it did not reduce the cost of handling bills or the correspondence with the division people, but that correspondence was now carried on before bills were rendered and forwarded to owners. The efficiency of this system over the first system was apparent when the monthly foreign car repair account changed from debit to credit.

Under the third system, all clerks writing billing repair cards were removed from the repair points and the whole clerical force engaged in rendering car repair bills is consolidated in one office. Original records are issued in duplicate by aid of carbon, the duplicate is filed at repair station and the original is forwarded to the billing bureau daily. System car repair records received in billing bureau, except those on authority of defect card, are filed on receipt, while foreign car and authority of defect card records are counted and turned over to the bill clerks to prepare bill.

The bill clerks write and price billing repair cards as per A. R. A. rules in one operation and a record is kept of the number turned out by each clerk per day.

In case additional information is necessary before bill can be rendered, the original record is returned to the traveling man located in the district and he personally takes up and explains to the employee originating the record the necessity for furnishing it. The original repair cards move on to the assorting desk where they are assorted into ownership and arranged in bill form. From the assorting desk they move to machine operators who list them in duplicate on bill form and complete bill. The completed bill passes to the audit clerk for audit and is immediately mailed on completion, while the duplicate bill is held and listed on the shop report at the end of the month, from which the record is placed in the ledger for collection. The first figures of audit number represent the month's account (1006 January account, 12006 December account). Duplicate bills are filed in binders, the backs of which are labeled Audit Number from — to — inclusive, which not only keeps file in first class shape, but also insures ready location of any bill.

Duplicate copy of repair cards for shop track repairs, together with any additional information that it was necessary to secure from repair station before bill was rendered, is attached to original record and filed in 1,000 pocket cases according to last three figures of car number. Notation showing serial number of original record is made on transportation yard repair cards and the repair card is filed according to last three numbers of car, while light repair and inspection records are filed by stations in date order.

Foreign road bills are checked and vouchered in a central billing bureau. Exceptions to charges are written on the back of the billing repair card and turned over to a stenographer who writes a letter to the party rendering bill. The checking is performed by the same clerks who render system bill. This practice is desirable on account of the education it furnishes in allowing clerks to see what

other roads charge and it tends to make uniform practice and charges in rendering and accepting bills.

All correspondence, answers to exceptions, are handled by the supervision of the office and any irregularities in pricing are called to attention of clerks responsible.

The latter system places in the billing office a complete file of all repairs made to cars, the value of which is apparent to all bill clerks in handling exceptions to bills as well as tracing for wrong repairs, etc. It reduces correspondence with the division people and delays in answering exceptions to the minimum. It removes all inclination on the part of division people to destroy bills as their responsibility ends with the mailing of records to the billing office, at the same time furnishing a complete safeguard aaginst wilful destruction in the billing office. It abolished the entire billing force at division points and relieved the car foreman of all accounting work, at the same time caused a payroll reduction of 50 per cent in the cost of handling bills and produced a higher degree of efficiency on account of closer supervision and the opportunity to educate the billing forces. The general results of the consolidated system have been satisfactory beyond our expectation.

Several railroads have adopted the practice of having the shopmen write combined original record and billing repair card at the car, which eliminates the copy work of transcribing from original record to repair card and will result in considerable reduction in clerical force and cost of handling bills.

This practice is not new as it was in vogue on a number of railroads some years back. The Baltimore & Ohio discarded it on account of the inability to have the men write the records; however, at that time the men were expected to work 10 hours and write up the records after completing the day's work without additional compensation and accordingly a great many records were not written. We are now experimenting along these lines in transportation yards and believe with proper supervision the work can be satisfactorily performed without delay to trains.

From our experience in the use of symbols in reporting information on records, we believe the writing of combined original record and repair card can be more satisfactorily performed by the carmen if the American Railway Association will adopt a code of symbols to be used by all railroads and I would like to see this Association recommend that standard symbols for showing kind of material, location and cause for repairs, be adopted. We believe there is considerable merit in the plan and if the American Railway Association will adopt standard symbols, it will save considerable time of the men in writing and at the same time insure uniform records going to the owners.

Discussion

H. M. Warren (B. & M.): I would like to ask approximately how much territory is covered by each of his traveling men?

Mr. Martin: We have 7,500 miles of road and five men—equally divided.

D. E. Bell (C. N.): We have 11,000 miles of territory. Just a question with reference to comparison of original record of repair card, in putting that into force are the originals made with carbon? In Canada it is absolutely impossible for a car inspector to work with carbons. I might say we are experimenting with comparison of repair card work in one office. The company I represent is the first to put it into force and we are putting it into effect now as soon as I can get around to the various points. At Montreal where the repair cards are being made at the cars the billing of repair cards on shop records is also going into the office and the bill for defects is being attached to the original record and being filed at the point at which it is made. It is impossible for a man in the yard to use carbons, for two reasons: one is the rain, the other is the ice. You understand that for three or four months out of the year it would not do for a man to take his glove off.

C. J. Hayes (N. Y. C.): A number of railroads are using the system billing repair cards, which we term the direct billing system of the car. This system is now being installed on the railroad which I represent and is working out very satisfactorily. We have installed it in the train yard as well as on repair track and in shop. We find that with proper instructions to the men they do not seem to have any trouble in using the carbon. This system enables duplicate copy to be kept at point and original billing repair card forwarded to central office where clerk inserts labor charge cost, net price, etc. We find also that this system reduces considerably the number of cases returned, but you will agree that where a number of clerks are employed in copying there are bound to be a great number of errors.

T. J. O'Donnell (C. I. I. Buffalo, N. Y.): Mr. Martin not only hits the billing repair clerk but he hits the interchange man and the poor inspector. I wonder if he realizes what we are up against to get good inspectors. You cannot get a college bred man to look for defects around the yards, possibly the B. & O. are following up to get good men to write up car records. A man may be a good inspector but cannot write out a defective transfer card as we would like to have them written.

E. S. Swift (Wabash). I wonder with the system of making repair cards and original records at the car, what they would do if we asked for an original record. If we got a bill from the B. & O. and we ask them for an original record what would they give us?

Mr. Martin: We would furnish you with an original copy of the record as made up by the man at the car. It has been my experience that a carbon copy is always the same as the original and I think it would be so considered by the A. R. A.

J. E. Gordon (N. Y. C. & St. L.): Mr. Martin spoke about wrong repairs going on cars but evidently he did not go into it thoroughly for wrong repairs are going on every day. With a foreign car we cannot insist, where a man in a repair yard applies an 8½-in. coupler, that he be compelled to put in 9⅛-in. If he puts in the same kind he should put a defect card on the car for wrong coupler and get blamed only for putting it in. It seems to me that where a car is stencilled for 8½-in. coupler to insist on a 9⅛-in. coupler would be wrong.

Mr. Cheadle: The speaker is either mixed up or I am. I understood him to say that if it comes in for an 8½-in. he would have to put in 9⅛-in. I could put in 9⅛-in. coupler and bill the owner.

Mr. Gordon: Rules do not provide for that; you must put in 9⅛-in. regardless of your stencil.

Mr. Jamison: I have a copy here of a letter written by Mr. Hawthorne who says in answering a similar question that:

The Arbitration Committee approves the following interpretation of Interchange Rule 101 which will be included in the next supplement.

Q. In the event of applying a coupler of A. R. A. standard type "D" 5 by 7-in. shank except that size of butt is 8½-in. In replacing defective coupler of same size account owner's responsibility what price may be charged for coupler applied?

A. If such coupler is standard to the car it may be charged at regular price for A. R. A. "D" coupler on same size shank.

Therefore in the case of defective "D" type coupler you could still bill the owner, but I presume he has reference to the old style of A. R. A. coupler.

Mr. Smith: I would like to inquire of Mr. Martin the

progress of that copy of the original record and repair card, as we all know there are more than two or three cars on the repair track. I wonder how the man who goes along gets his information and how he puts it down, whether he waits until everybody gets through and then writes it up and how he kept the original record of repairs made to the cars.

Mr. Martin: We are not writing combined original record and repair card on shop track. We are using A. R. A. standard original record on shop track, because the investigation we made did not show up to our satisfaction, that they were any cheaper. However, in our transfer yards where no light repairs are made, we are experimenting along that line. We are making transfer repairs in triplicate, this is done for the purpose of maintaining a complete file in billing bureau office. Any bill clerk here readily recognizes the advantage of having original record in the office. The advantage is in answering correspondence, because correspondence can be answered the minute it comes in, you go over to the file and readily find your original record. There is no question as to the information on file there, therefore you do not have to go back to the repair station, you do not have to write any correspondence with the foreman, you have reduced the clerk's work and the foreman's work, so far as checking the amount of work done is concerned, to practically nothing.

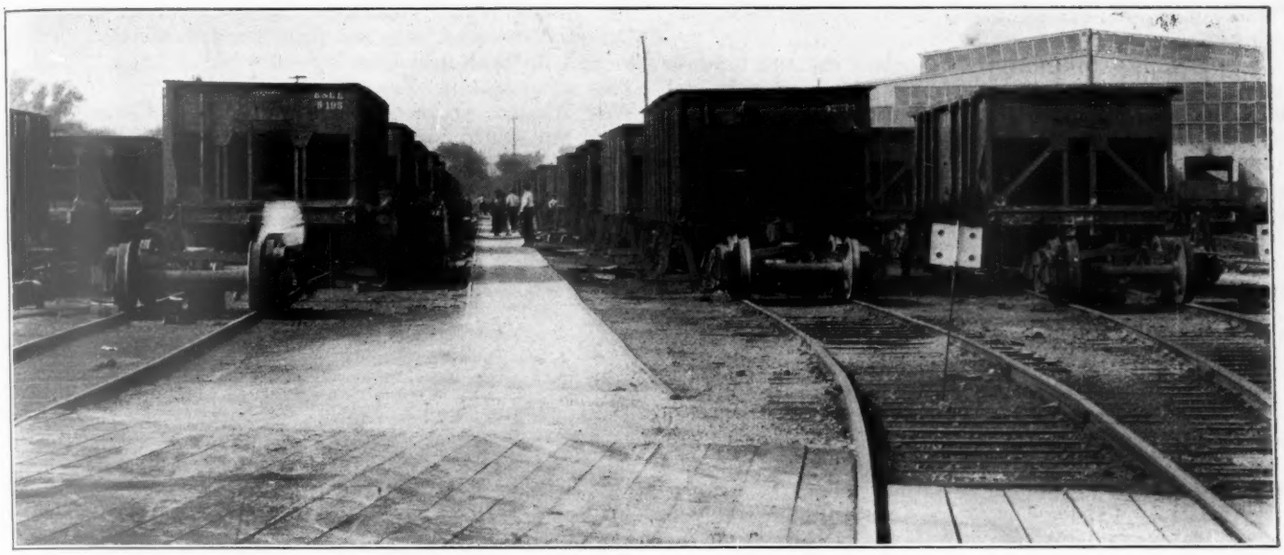
M. E. Fitzgerald (C. & E. I.): Rule 7 provides that under that protection you must make an original record, no objection to a carbon or any other record but original record must be made first and billing repair card written from it.

Mr. Hayes: This is how the system works out if you use a holder, some railroads use a tin holder, others use aluminum and some have adopted an agosote board which will withstand the elements and is set together by either rings or studs. These boards are prepared in the office by a clerk who places one at every track before the inspector starts, when the inspector arrives at each car he finds the board with repairs to be made marked thereon, one for home cars and one for foreign; the ones for home cars are not made in duplicate, just one copy, if the car is a foreign you have a carbon.

The inspector as he comes to each car picks up the board and notes what it calls for. Such items as bolts and nuts that he cannot determine when he checks the car, are put in later and he shows whether they are renewal or R. & R. The board is taken into the car foreman's office at night and tickets are removed and the top copy for the billing repair card is sent to the clearing house for insertion of labor and material and duplicate is sent into the freight foreman's office and filed. So far as the statement made that this would not serve as original record, I do not see why, because the rules provide that the billing repair card shall be prepared from the original record, and the rules do provide that, but I do not believe that the A. R. A. will ever go on record as turning down a proposition for the railroad when they know there is a big saving involved and we certainly realize that. Now by eliminating the work of transcribing the information from the original record to the billing repair card you have the original record at the car and not made in the shanty, but made by inspector at the car.

The reason for the taking of a strike vote by train and engine service employees of the Texas & Pacific was explained to the Railway Labor Board in Chicago on February 12 by representatives of the Brotherhood of Railroad Trainmen, the Brotherhood of Locomotive Engineers, the Brotherhood of Locomotive Firemen and Enginemen, and of the managements of the Texas & Pacific and the Missouri Pacific. The employees maintained that agreements between them and the management of the road had been violated through the operation of Missouri Pacific trains by Missouri Pacific train crews over the line of the Texas & Pacific between Alexandria, La., and New Orleans. According to testimony of representatives of the railways, joint operation of the Texas & Pacific with the Missouri Pacific had begun in 1916 and had not been seriously protested until 1923. It was also pointed out that while present officers of the labor organizations now oppose such operation, previous officers had conceded to the Missouri Pacific the right to operate its trains with its own crews on joint tracks.

Side bay caboose used on the Akron, Canton & Youngstown



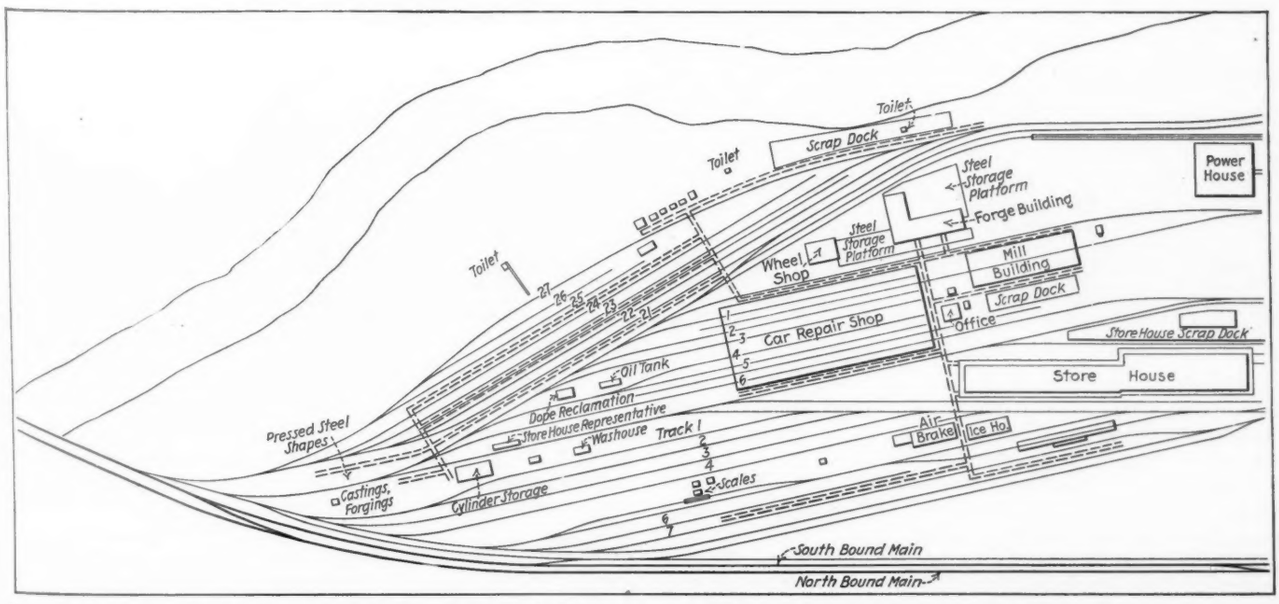
View of the West Yard—The limestone driveways are kept clear of material to permit free passage for the tractors and trailers

Repairing freight cars by the progressive system

Efficient handling of material and gang organization facilitate production on the B. & L. E.

FOR a number of years the Bessemer and Lake Erie has been repairing freight cars at its principal car repair point, Greenville, Pa., by the progressive system. Since the installation of this system a number of improvements and refinements have been introduced, especially in the method of handling scrap and new material, and in the organization of the repair gangs.

These shops are required to handle the heavy repair work necessary to maintain approximately 15,000 cars. The Bessemer has approximately 32 different classes of open-top cars of all-steel construction designed primarily for carrying iron ore, limestone or coal, and in addition quite a number of flat, composite, box, stock and refrigerator cars of which there are about eight different classes. It is the practice of the car department, whenever possible, to schedule one class of open-top and one class of closed



Layout of the tracks, buildings and driveways of the freight car repair shops of the Bessemer & Lake Erie, Greenville, Pa.

cars through the principal repair shops at Greenville, Pa., at a time.

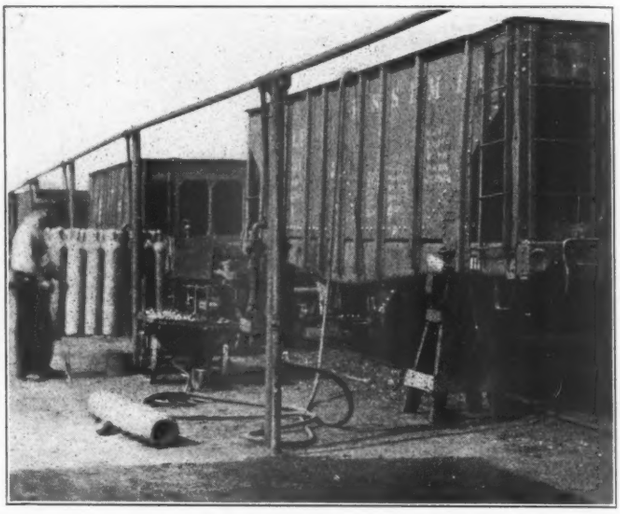
Referring to the layout drawing, box car and caboose repairs are handled on track No. 1 of the car repair shop building, which has a capacity of 48 cars. Located adjacent to this track is a material track which runs directly through the wood mill, tracks Nos. 2 to 6 inclusive are used primarily for repairs to composite and closed cars having wood superstructures. These tracks, however, are also used at times for open-top cars of all-steel construction. Tracks Nos. 25 to 27 inclusive are used for the storage of cripple gondola and hopper cars while tracks Nos. 21 to 24, inclusive, are used for the repairing of all-steel hopper and gondola cars and have a capacity of 55 cars.

The part of the yard in which these tracks are located is known as the West Yard. A total of 176 men are employed in this yard which has an output of one car per hour or eight cars per day. A total of 90 men are employed in the shop building which has an output of 4½ cars per day. Tracks Nos. 1 to 7 inclusive are located in the East Yard, of which track No. 1 is used as a material track, track No. 2 for light repairs and Nos. 3 and 4 for the storage of cripple box, stock, refrigerator cars, etc. Tracks No. 6 and 7 are used for the painting, stencilling and testing of repaired cars of all classes. The scales for weighing are located adjacent to track No. 5.

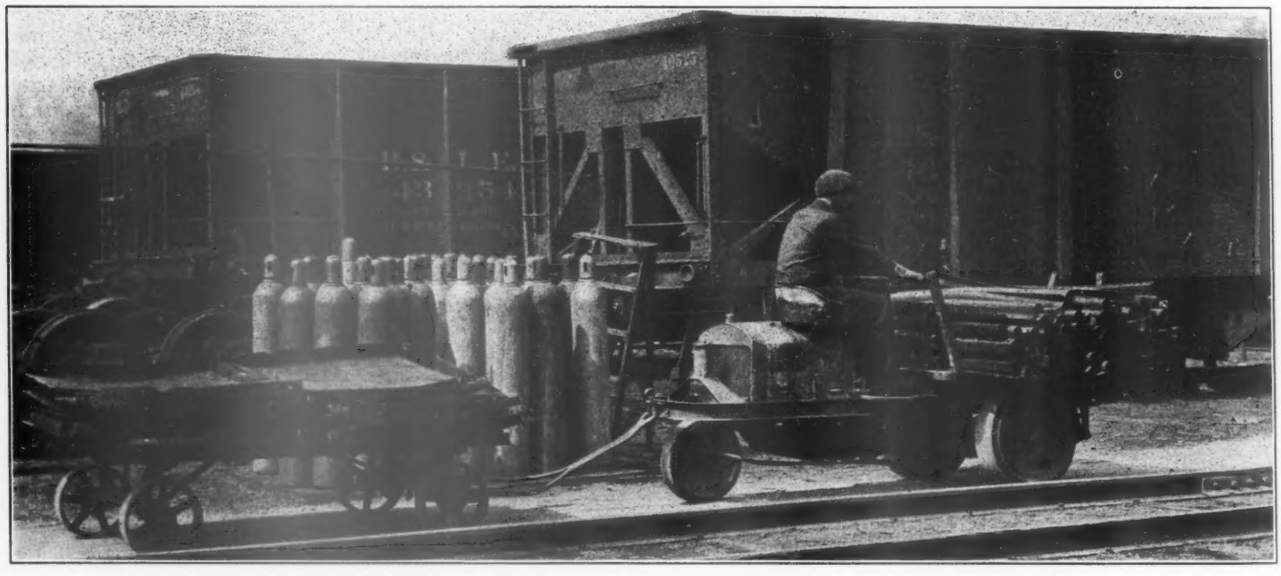
System of handling new and scrap material

The feature of the car repair work at the Greenville car shops is the system in use for handling scrap and new material. A progressive system of car repairs, of course, requires an efficient system for handling material in order to function properly. The success of the system is due primarily to an effective liason between the car and stores departments. A representative of the stores department has an office located near the south end of the car repair yard through whom all requisitions for material are cleared.

A system of limestone driveways, shown by parallel dotted lines on the drawing, is laid out strategically throughout the yard for the operation of gasoline tractors and trailers. Referring to the layout drawing of the car repair shops and tracks, provision has been made for the storage of pressed steel shapes, castings and forgings and also acetylene gas cylinders at the south end of the yard. Driveways extend from this point through the West Yard to a scrap dock which is located west of track No. 27. This scrap dock handles all of the scrap coming from the West Yard. Another scrap dock is located east of the wood mill which handles all of the scrap coming from the car repair shop building and the tracks directly south. The main scrap dock is located adjacent to the storehouse at which point most of the work of reclamation is performed, the other two scrap docks being used primarily for sorting. The work of collecting scrap is handled by tractors and trailers with a crew of eight men who are under the supervision of the general scrap foreman.



The equipment for each gang is designed so that it can be easily moved from car to car—View showing a car body on which a rivet gang is working



Tractors and trailers of the type shown in the foreground are used for transporting material

The car repair work in the West yard is under the supervision of a foreman and two assistants. An assistant foreman inspects each car to be repaired and marks the parts for repair or renewal. The delivery man who has charge of the delivery of material follows the assistant foreman as he inspects the cars and records in an order

book the number of the car, and the items of material required. As soon as one track has been completed the delivery man turns the order book in to the stores department representative, who has charge of six men who load the material required on trailers stationed at the material docks located at the south end of the yard. The tractors

Adequate transportation facilities are provided for removing all scrap material from around each car as soon as it is thrown out, the only material left is that which goes back on the car

which operate under the supervision of the delivery man, then take the loaded trailers and deliver the material directly to the cars.

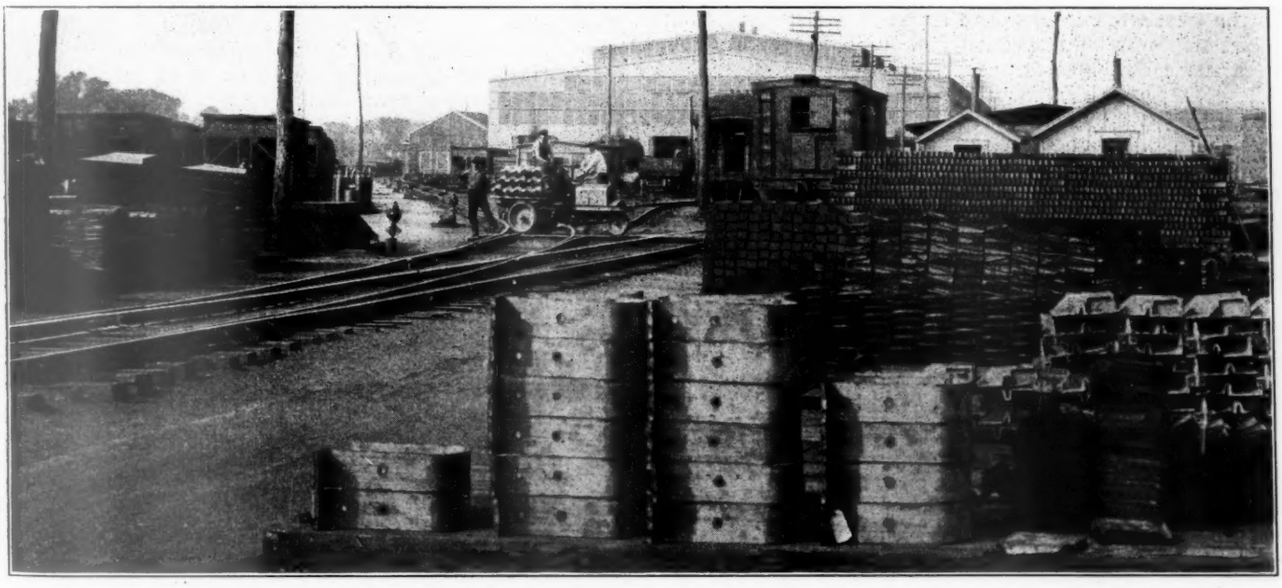
Orders for material kept in the storehouse building are handled by telephone, the telephone order forms being filled out from the shop clerk's order book, of which there are a number in circulation. Through the operation of this delivery system, the stores department has supervision over all material until it is placed on the trailers to be delivered by the car department directly to the cars.

The cars are jacked up by a gang of four men who go along each track ahead of the assistant foreman who inspects the cars. The assistant foreman who does the inspecting is also in charge of the gas cutters and gangs who cut the cars down. The work of gas cutting is performed by one man, who is followed by a gang of four men who back out the rivets, throw out the sheets and make the cars ready for the fitters. After the make-ready work has been completed a gang of fitters in charge of the other assistant foreman fit all the parts together by means of key bolts, as shown in one of the illustrations, ream the holes, and prepare the car for the rivet gang.

Organization of repair gangs speeds up production

The rivet gang consists of four men who directly follow the fitter gang. The equipment for this gang consists of a portable rivet heater in charge of one man while the work of placing the heated rivet in the hole, driving and bucking up is performed by the other three men, respectively. The finishing-up gang, consisting also of four men, applies the couplers, draft gears and safety appliances. A gang of two men repairs the trucks while the body work is in process of completion. The air brake gang goes ahead of the dismantling gang and takes down the air brake equipment which is repaired and applied after the rivet gang has completed its work. The foreman in charge of the West Yard makes a final inspection and the shop clerk makes out work reports for each car.

Practically the same system is used in handling the repair work performed in the car repair shop building. The carpenters who perform the wood work on the superstructure of the box, stock and refrigerator cars move from car to car as their part of the work has been completed, and after one track has been finished, start down the next. Lumber is stored at the north end of the wood mill and is handled from storage by rail push car directly into the wood mill. As it is finished it can be taken directly to track No. 1 either by push car or gasoline tractor and trailer, and delivered direct to the car where it is to be used. The same system is also used when hopper or gondola cars are repaired in the shop building.



View taken from the south end of the car repair yard—The casting dock is shown in the right foreground, and directly in the rear is the gas cylinder storage shed—The coach shown in the upper center of the picture serves as an office for the store house representative

The system used for reclaiming car journal packing was described in the April, 1925, issue of the *Railway Mechanical Engineer*, page 219. The work of packing the

journal boxes is left until the cars are spotted on tracks Nos. 6 and 7. The journal box packing gang, consisting of three men, removes all the packing from the journal boxes and transports it in low-side steel wheelbarrows to a steel storage bin located just outside the oil and waste reclamation building. This building, referring to the drawing, is located midway between the wash house and acetylene cylinder storage shed.

Painting and testing

Sufficient tractors and trailers are provided for the general scrap foreman to remove all scrap from around each car as soon as it is thrown out. This facilitates the work of the car repair men and also enables the yard switching crew to pull the cars from each track as soon

The work of stencilling is performed during the final inspection and testing of the air brakes

as the steel work is completed. After the foreman completes the work of inspection and the work reports have been made out, the cars are switched to the East Yard where they are painted. The work of painting is performed by a gang of three men, two of whom operate mechanical painting equipments and the third man follows with a brush and wipes the paint down. Upon completion of the work of painting, the cars are weighed and placed upon tracks Nos. 6 and 7 where the brakes are tested and a final inspection is made. The cars are stencilled on the test tracks.

Decisions of the Arbitration Committee

(*The Arbitration Committee of the A.R.A. Mechanical Division is called upon to render decisions on a large number of questions and controversies which are submitted from time to time. As these matters are of interest not only to railroad officers but also to car inspectors and others, the Railway Mechanical Engineer will print abstracts of decisions as rendered.*)

The proper rider protection not provided in flat switching service

Under date of March 14, 1923, the Terminal Railroad Association of St. Louis, submitted to the Atlanta, Birmingham & Atlantic, an inspection certificate covering the condition of A. B. & A. flat car No. 5056. The inspection certificate bore the date of March 8, and showed the condition of the car to be as follows:

2—side sills split and broken,
2—draft sills split and broken,
2—intermediate sills split and broken,
1—end sill broken, new and old,
1—deadwood broken,
6—section struss rods bent and broken,
15—ft. of decking split, broken, worn and damaged.

The handling line considered that the car represented a case coming within the scope of A. R. A. Rule 120, as the estimated cost of repairs exceeded the limit allowed, except upon authority from the car owner. The car owner was requested to furnish disposition for the car. The car owner contended that the damage to the car represented unfair usage as the car was kicked without proper rider protection, and that it should be repaired at the expense of the handling line. The handling line contended that the car failed in ordinary switching service owing to its decayed and weakened condition. It further contended that it was neither the custom nor the requirement from the standpoint of safety to provide rider protection in flat yard switching service. The reason for this is that the cars are not switched at an excessive rate of speed and that the grade in the yard is not such as to cause cars to gain speed after being cut off.

In rendering its decision, the Arbitration Committee stated that, "The car was handled without required rider protection, as per Rule 32, Section D, Item 4; therefore, the handling line is responsible. See Decisions 1224 and 1331.

"With reference to the requirement for rider protection, the rule does not make any distinction between hump switching and flat yard switching."—*Case No.* 1347, *Atlanta, Birmingham & Atlantic vs. Terminal Railroad Association of St. Louis.*

Car protected by a rider before being damaged in switching service

Under date of December 26, 1923, the Terminal Railroad Association of St. Louis, submitted to the Atlanta, Birmingham & Atlantic, an inspection certificate for A. B. & A. flat car, No. 5160. The certificate indicated that the following repairs were required:

2—draft sills, split and broken,
2—intermediate sills, split and broken,
2—side sills, split and broken, new and old,
1—end sill, broken,
2—dead woods, split and broken, new and old decking, broken, worn, missing and damaged,
12—sections of truss rods, bent,
2—needle braces, broken,
3—sub-sills, broken.

The handling line reported to the car owner that the estimated cost of repairing the car at labor and material prices then in effect, amounted to $311.55, which exceeded the allowance under Rule 120 and, therefore, authority was requested to render a bill to the car owner or to dismantle the car. The car owner contended that the damage to the car resulted from improper handling as was indicated by the fact that the inspection of the car showed that it was entirely broken in two and that all sills showed new defects. The owner also contended that the car was in a previous accident as was confirmed by the statement of the car rider which was to the effect that timbers had already been broken in the car before it was broken in two. The car owner asked the handling line to furnish full information as to the previous accident but the handling line was unable to do so. Therefore, the car owner maintained that A. R. A. Rule No. 43 applies to this case, as there were more than five sills broken in the car. Furthermore, it contended that the car was improperly handled, as the cars which struck the damaged car were kicked without necessary rider protection, the rider having left the cars after riding them a short distance. The handling line stated that it complied fully with the requirements of Rule 43, as it furnished a state-

ment showing the manner in which more than five sills were broken, and presented the statement of the car rider which showed that the brakes had been set on the cut of nine cars which came in contact with the car damaged.

The Arbitration Committee rendered the following decision: "In accordance with the evidence presented, there was no mishandling on the part of the Terminal Railroad Association of St. Louis. The car owner is responsible." —*Case No.* 1348, *Atlanta, Birmingham & Atlantic vs. Terminal Railroad Association of St. Louis.*

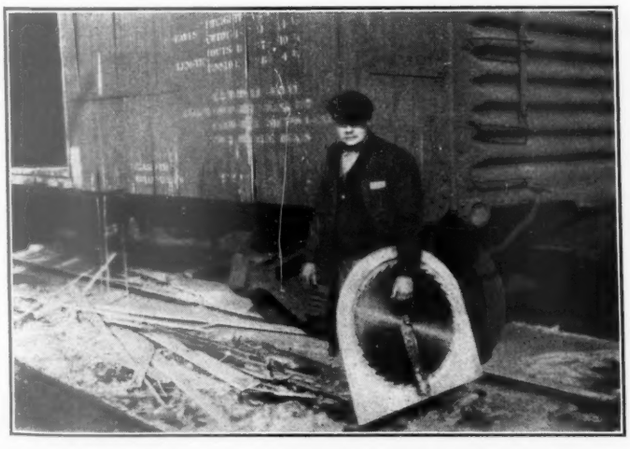
Statement must be furnished when wheels and axles are removed and replaced

On October 27, 1923, the Pere Marquette removed and replaced a pair of steel wheels on Bessemer & Lake Erie car No. 9251 on account of a cut journal. No wheel statement was furnished and when the car owner requested a statement the repairing line refused to furnish one on the ground that the rules do not contemplate the issuance of a wheel and axle report except when different wheels are applied from those removed. The car owner considered that this wheel statement was required for the reason that it is necessary for the owner to know whether the axles applied are within the limits of paragraph C, Rule 86. From the standpoint of the rules, the car owner claimed that it was required by Rule 9 that all the information shown in the second paragraph of that rule shall be furnished whenever the wheels and axles are removed and replaced. The handling line contended that as a "no bill" repair card covering the operation was issued, it was not necessary to list the data required in the second clause of Rule 9 and that this data should be furnished only when the wheels and axles are exchanged.

In rendering its decision the Arbitration Committee stated that "where the same wheels and axles are removed and replaced on account of a defect on either, a statement on the required form should be furnished regardless of responsibility for repairs."—*Case No.* 1349, *Bessemer & Lake Erie vs. Pere Marquette.*

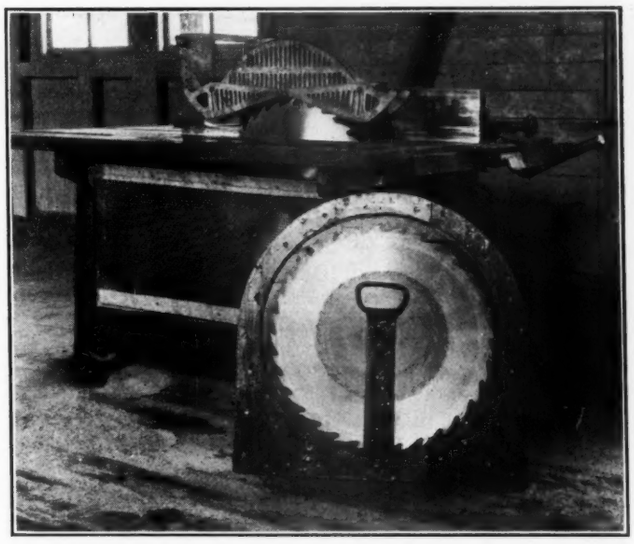
Protecting a rip saw and carrying saw blades

NO means were provided in guarding against the possibilities of a foreign object from coming in contact with the revolving saw blade in the rip saw shown in the accompanying illustration. Another rip saw is opposite the one shown. As a result of this arrangement, a workman handling a long piece of material, caused the end of it to come in contact with the revolving saw of the other machine with unpleasant results. The circular blades are now protected by a heavy piece of wire netting fastened to a substantial frame.



Seven rip saw blades can be carried with ease in this frame

Where this rip saw is located, no facilities are provided for sharpening the circular saws. As a result the saws must be sent to another shop for sharpening. As saw blades of this type are awkward to handle, the frame shown in the illustration was designed so that they could be easily carried. It is made of wood and contains a circular offset in which the blades fit. It will hold seven blades up to 24 in. in diameter. They are held in place by a 5/8-in. bolt and a wing nut which is screwed up tight against a 3/8-in. by 2-in. wide metal strap with a handle at the top end. The frame is painted black and has on the back, in yellow letters, the name of the two shops between which the saws are shipped.



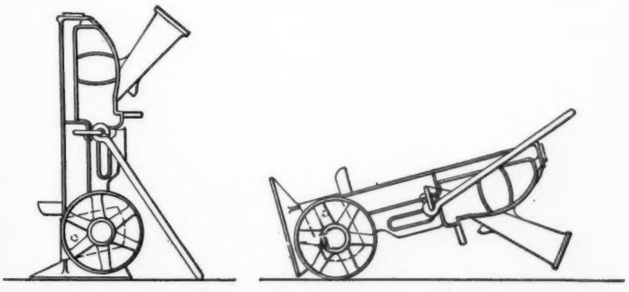
Wire guard for protecting revolving rip saw and frame for carry saw blades

Portable journal brass jack

By G. H. Fahrenbruch

General car foreman, C. B. & Q., Sheridan, Wyoming

THE accompanying illustration shows a portable journal brass jask which was made from a 15-ton ratchet foot jack by cutting out part o f the jack at the base and applying a pair of wheels and a handle.



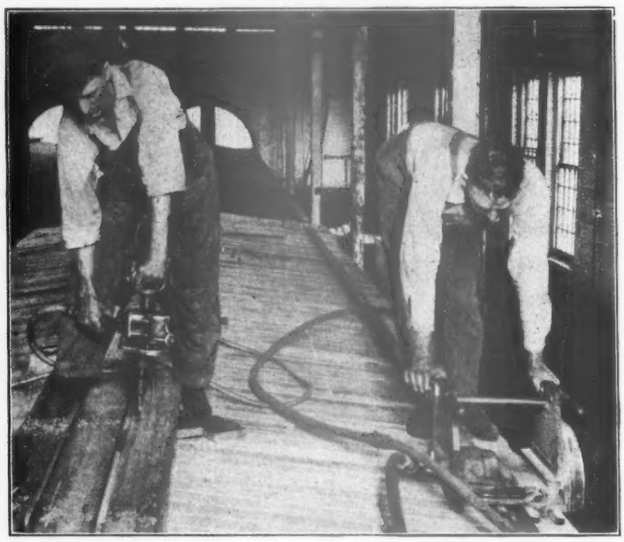
The left view shows the jack in position for jacking up a journal and the right view shows its position for movement

It is used for the jacking up of empty cars where it is necessary to remove the brasses for examination. Much time can be saved by the use of a jack of this type as one

side of the truck can be jacked up and both brasses changed in one operation. No blocking is required for setting up the jack. Furthermore, as the jack is on wheels additional time is saved as one repairman can move it from one job to another with little effort. This jack has been in service for over a year and has resulted in a substantial saving in time and labor on the repair track.

Air motor tools for use in car repair work

THE extent to which portable air motors can be used in car repair shops is indicated by the illustration. Two devices are shown, one of which is a motor driven screw driver and the other a circular saw for trimming the ends of roofing boards after being applied. With the aid of the motor driven screw driver, two men can apply running boards to a box car in 30 min. This includes the application of 18 saddle screws; 176, 3½-in. No. 16



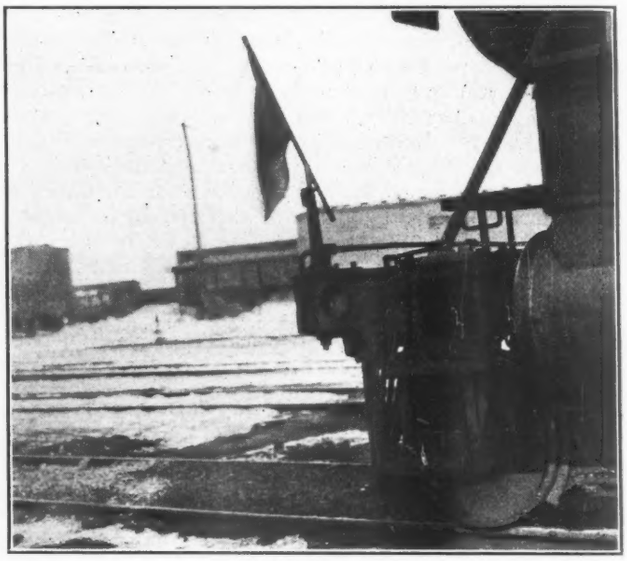
Motor driven screw driver and circular saw facilitate production in repair box cars

screws; two running board ties, and four running board braces. By removing the screw driver and inserting a socket wrench in the spindle shank, the air motor can also be used to tighten the nuts on the ½-in. bolts through the ties and end plates.

One man, with the motor driven circular saw, can trim the ends off the roof boards on both sides of the car in 12 min. This time includes the laying of the guide strip which serves to guide the saw as it is moved along the car.

Novel arrangement of flag to protect repairmen

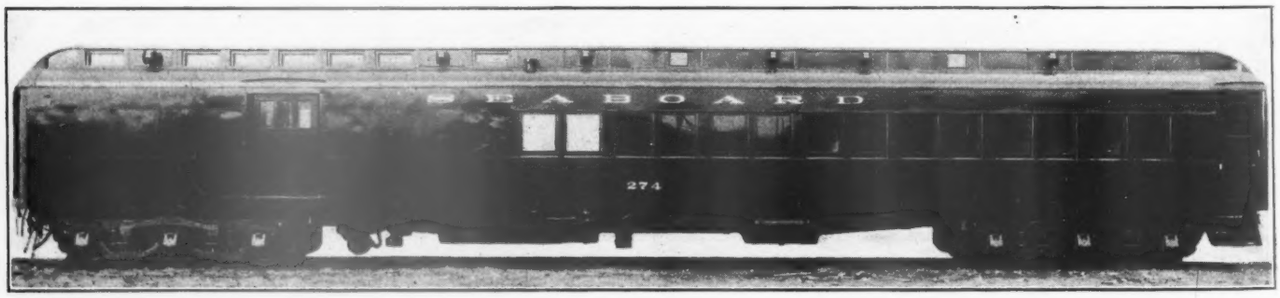
WHEN a yard engine comes in a repair yard to shift out cars or when a road engine is waiting to couple up with a train, the enginemen are often unable to see the flag protecting the repairmen. As a result many car repairmen have been either killed or injured. To eliminate this situation the flag shown in the



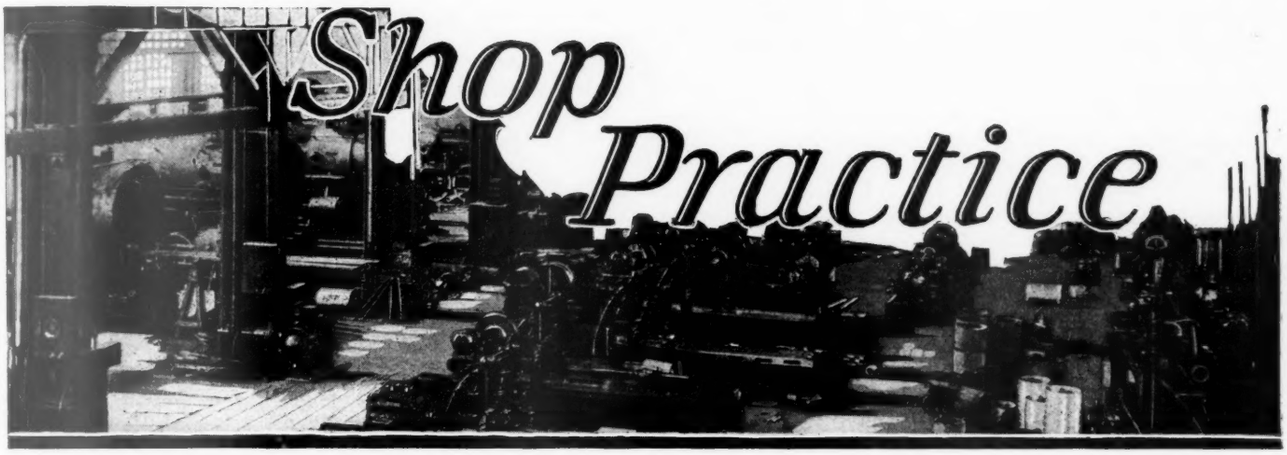
Flag projects over track at a 45 deg. angle, which permits a better view for the engineman

accompanying illustration has been fitted with an auxiliary stick made of sheet metal and curved so as to fit the circumference of the wood flag stick. The auxiliary handle is pivoted to the wood handle by a ⅛-in. pin. When the locomotive is waiting to couple up to the cars on which repairmen are working the metal handle is inserted into the flag bracket, so that the flag projects out at a 45 deg. angle with the flag bracket from the track where the engineman can see it.

This flag was designed at the Secaucus, N. J., car repair yard on the Delaware, Lackawanna & Western and is used at all of the repair yards and outbound train inspection points on this road.



Combination passenger and baggage car built for the Seaboard Air Line by the American Car and Foundry Company



Engine truck lubrication a serious problem

Present methods largely wasteful and ineffective—Causes analyzed—Remedies proposed

By W. H. Davis

General Sales Manager, Universal Packing & Service Company, Chicago

THE editor of the *Railway Mechanical Engineer*, in asking "What about engine truck lubrication?" has invited a discussion of what is admitted by most men in the lubricating field to be the most difficult point of lubrication on a railroad train.

Close contact for a number of years with railroad lubrication problems leads me to believe that less mileage is realized per hot engine truck journal box than for driving boxes, rod pins, trailer boxes, tank boxes or M. C. B. journal boxes on passenger cars. This condition, not peculiar to any individual railroad, is quite general. The freight car journal bearing is the only one in railroad service which affords less mileage per hot box than that realized with engine truck journals.

The difficult problems of engine truck lubrication are not new. They have been with us as long as the trucks themselves, but they have been particularly aggravating during the last year or two, coincident with the inauguration of longer locomotive runs. Hot engine truck journal boxes are more frequent on long runs, covering two or more divisions, than on the short division runs although there are, at times, too many of them on the short runs.

Truck frames covered with oil

The examination of almost any locomotive at the end of a long run will show that the engine truck frame, equalizer bars, springs, etc., is covered with oil—a veritable splash system apparently works quite efficiently on everything except the journals. This condition has always been prevalent. Long runs are not the cause; they merely make the condition more acute.

Only a comparatively small amount of waste and oil is used under an engine truck journal as compared with the amount under other journals of the same, or sometimes smaller, diameter. Yet the engine journal is subjected to the hardest service possible. A great many engine truck cellars are entirely too small and will not hold sufficient dope to produce good lubrication results. This is purely a question of design. The smallness of these cellars is probably due to the necessity of maintaining a stipulated under-clearance with a constantly increasing size of locomotive. The designer finds himself limited in the depth of the present style cellar on modern locomotives.

There is another objectionable feature of the shallow cellar. It is practically impossible to keep any kind of journal box packing in proper position in a shallow cellar. The dope becomes misplaced; rides up along the side of the journal; dries out under temperature, producing a waste wiper; or is in a position, when the brass jumps, to get between the brass and journal and cause a waste grab. Any one of these conditions eventually results in a hot box and, in many cases, in an engine failure.

On a new and properly designed locomotive there is a proper distribution of load on engine truck, driving and trailer journals. Between shoppings, the load can become quite unequally distributed by a weakening or improper alinement of the springs. A shifting of additional weight to the engine truck creates greater loads than intended and high temperatures result. A condition then exists which cannot be overcome by the medium of lubrication.

Engine truck bearings are subjected to a terrific hammering impact, due to crossovers and unevenness of roadbed, this condition being more prevalent immediately preceding a heavy cold snap or following it, when the roadbed has numerous "hard spots" due to uneven drainage. This condition tends to bring an increase in hot box troubles, especially cracked journal brass linings.

The foregoing are a few of the principal mechanical conditions peculiar to engine trucks that have to be faced

continually. How about maintenance and operating difficulties, so vitally affected by the human element?

From the very character of the construction, it is a far more difficult job to dope engine truck cellars properly than M. C. B. journal boxes and the majority of outside trailer boxes. When a locomotive momentarily stops at an intermediate terminal, it is comparatively easy to give the necessary service attention to rod pins, trailers and M. C. B. tank boxes, but, owing to the fact that the engine truck cellars are inside of the wheels in an inaccessible position it is practically impossible to give them any service attention under present conditions and practices, other than the application of a little top oil by the engineman.

We must recognize, when comparing long with short engine runs, that the physical characteristics of the situation are such that the roundhouse force cannot give any better attention to a long run engine truck than to one on an engine used in short run service. Therefore, from a lubricating viewpoint, the engine truck journals are expected to function for three or four times the distance on practically the same amount of terminal service attention. This is inconsistent, and the results show that engine truck journals do not function as well in the longer runs unless supplemented with service attention at intermediate terminal points. This intermediate service attention may seem poor practice and a waste of material and labor but it is vitally necessary on the long runs under present conditions and design.

Dope unduly dry following long runs

It has been found on a number of different railroads that the dope in the cellars lacks oil at the end of a long run, having the appearance of being well dried out. Evidently there is a substantial loss of oil from the dope while en route, through some definite cause. It is also a fact that far more hot engine trucks develop on the last part of a long engine run than on the first part of the run. The natural question is, "Where has the oil gone that was originally in the dope and by what medium did it pass from the dope, journal and bearing, to its new surroundings?"

A considerable part of the oil which should be in the cellar, on the journal, or between it and the brass, has distributed itself about the engine truck frame and on the right-of-way to such an extent that from 40 to 50 per cent of the original oil can be lost in one long engine run, necessitating a complete re-oiling or re-doping before the engine is started on its return trip. Why is this the case when trailer and tank boxes run continuously for a considerable period without any re-doping and with but occasional re-oiling?

Some are inclined to assume that the loss of oil in engine truck journal boxes is due to evaporation. This is an impossibility, for when the oil has reached a temperature to give off inflammable or combustible gases, it is on the danger line of the flash point, and, even though it stayed near that danger line throughout the trip, the entire loss of oil due to evaporation would not begin to account for the total oil loss. Therefore we must grant that evaporation is not the prime cause.

Lubricating engineers agree that the proper place to lubricate a journal bearing is from the bottom or sides. On an engine truck journal we locate an oil hole at the top, the most difficult point of lubrication and we have been trying for years to apply extra oil through that opening to take care of the rising temperatures which may develop en route when it is a point of egress rather than ingress.

What actually happens is this: the oil, by capillarity, leaves the dope in the cellar, distributes itself into a film between journal and brass, then collects in the oil slot in the lining of the brass at the top of the journal, is pumped from there through the oil hole in the brass, some of it going on up through the engine truck box oil hole, the majority of it passing between the brass and box, down the sides of the box, past the cellars, to be whipped by the wind over the engine truck frame and the right-of-way. Undoubtedly a small part finds its way past the ends of the cellar and box onto the axle and hub-plate.

The construction of the journal, oil groove and oil hole appears to form a very neatly working centrifugal pump. The majority of the oil collecting in the oil slot does not again find its way between brass and journal as this is the approximate point of greatest load and oil pressure. It would be most natural for it to follow the direction of least resistance, the exhaust port, so to speak, which is the oil hole leading to the atmosphere. That this action does take place, can be determined very easily and by simple methods.

I am quite convinced that about all the engineman has been doing on engine trucks with his oil can at intermediate stations is to prime the pump for further action when his locomotive is again under way, much to the detriment of the condition of the dope in the engine truck cellars.

When a locomotive is in transit, there is a constant pressure of oil struggling for freedom and it is greatest near the top of the journal. This pressure is determined by the load and speed and also increases in direct ratio with the increase in speed of the locomotive. This oil pressure is greatly diminished when the locomotive is at rest and when it hits a hard spot in the road bed or a cross-over when traveling at a fair speed, at which time the brass leaves the journal and momentarily relieves the pressure.

The idea of the oil being pumped up through the oil hole by centrifugal pump action, or whatever else we may choose to call it, may be new but there is plenty of precedent to sustain the conclusion that we are now thinking along correct lines. Take a few specific instances for illustration. That of the engine driver grease cellar is a good one. During its first application there was an oil hole in the top of the driving box. The grease came through this oil hole like shaving cream from a tube. An effort was made to overcome this by plugging the oil holes with tapered plugs. The grease pressure was sufficient to force out the plugs. The oil holes were eliminated and desirable lubrication was achieved.

Added oil gave temporary relief

I recall one railroad that began to have an abnormal number of hot engine truck boxes when the long engine runs were started. Those in charge realized that the oil was leaving the cellars and they made some long squirt oil guns with which the men could reach across the engine truck frame. At intermediate engine terminal points the mechanic would place the nozzle of the gun in the neck of the journal cellar and insert additional oil on the dope. Engine truck hot box troubles soon became a thing of the past on this road. I do not intend to imply by this illustration that the foregoing was desirable practice or the best way to effect a cure, but it does show that the adding of oil stopped the trouble, which is a strong indication that it was the lack of oil which caused the trouble.

On another railroad, where they had considerable engine truck trouble on long runs with certain high speed locomotives, they were having no trouble with locomotives of exactly the same type, running one-half the distance and over the same line of road. The cellars of the former showed a lack of oil at the end of the long run while the cellars of the latter had sufficient oil, not running far enough for the loss of oil to become vital.

Basing my deduction entirely on personal observations of extensive experiments carried on by railroad men, with all credit to them for the progress made, I find myself thoroughly convinced of the following facts:

There is, and always has been, a substantial loss of oil from engine truck journals while in transit. The loss is making the cost of engine truck lubrication greater than it should be and it is detrimental to cool running of the journals. The occasional top oiling by the engineman appears to be a rather useless and wasteful procedure. The major loss of the oil is through the oil hole in the brass.

Suggested alterations in practice

The oil hole should be eliminated, but a method of applying oil to the dope should be incorporated so that a quick rising temperature, en route, due to some mechanical defect, can be overcome by adding the necessary oil. The application of additional oil should only be made when necessary on account of high temperature. Everything being normal, the engine truck should run from main terminal to main terminal without any additional oil. Eliminating the oil hole in the brass is suggested as a method of securing improvement on present equipment without any expensive or radical change in design. One important railroad has already developed changes along this line.

To offset the difficulties permanently, it appears desirable to redesign the engine truck box and cellar. A practical method would be to have a ledge on the inside wall of the engine truck box (cast steel, only) and have the cellar slide into position with its side walls behind the ledge, so that the oil running down the inner sides of the box would return to the cellar instead of going down past the cellar walls, as at present. Also, a real improvement can be realized if the cellars are designed with more depth than many of those now in service.

It is absolutely essential, in order to secure desirable engine truck journal lubrication, that the engine truck cellars be taken down and the dope put in proper condition before the cellars are again returned to place. This should be done every trip on all passenger and high-speed freight locomotives. If done on all locomotives it would probably be money well expended. When the cellars are down, a very careful examination of the journals, brasses and co-related parts, by a competent employee, will bring results and reduce the number of high temperature journals.

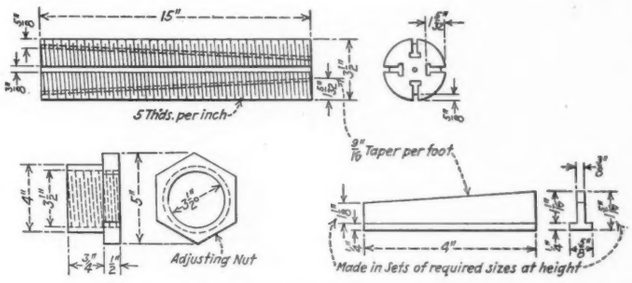
Hot boxes are like the proverbial taxes. They have always been with us, are with us and probably always will be, but we hope in constantly decreasing numbers. The majority of the railroads are constantly striving for better lubrication and the splendid results obtained are indicative of the success of their efforts.

A number of the principal railroad systems of the country are now getting more than 250,000 locomotive miles per hot box, more than 1,000,000 passenger car miles per hot box and more than 100,000 freight car miles per hot box. A comparison of these results with those of a few years ago, shows that tremendous progress has been made. In conclusion, I venture the prediction that each succeeding year will show a continued improvement.

POLISH ENGINEERS have calculated that it costs 186,000 zloty ($35,898) to manufacture a standard locomotive in Poland compared with 220,000 ($42,460) in England, according to Assistant Trade Commissioner Ronald H. Allen, Warsaw. In Germany, locally manufactured locomotives are produced at figures about equaling costs of manufacture in Poland, but the export price on the German product, owing to the dumping system, is less than the Polish manufacturers can sell for.

Adjustable rod brass and bushing arbor

AN adjustable arbor used for turning the outside of rod brasses and bushings is shown in the drawing. Four taper slides fit into tee-shaped grooves machined in the arbor spindle. Taper slides of various heights can be used as required for different diameters of bushings or



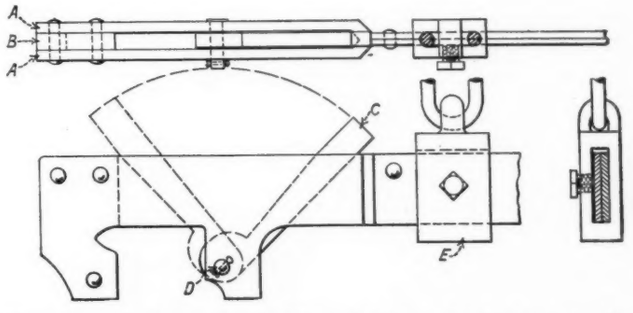
Drawing showing the detail parts of an adjustable arbor for turning bushings or rod brasses

brasses. The spindle, with the taper slides in place, is inserted through the center of the bushing or rod brass and the slides are set up and held to the work by the adjusting nut which is threaded to screw on the spindle. The use of this adjustable arbor enables the operator to turn rod brasses and bushings with little adjustment after it has been once placed in the lathe.

Clamp for holding tires on a boring mill

By F. M. A'Hearn

THE clamp shown in the drawing will be found convenient for holding driving wheel tires when placed on the table of a boring mill or when stored in piles, one on top of the other. The side pieces *A*, *A* are separated at one end by a filler block *B* so as to form a housing for the cam *C*. The side pieces of the section occupied by the cam *C* are drawn together as shown in the drawing,



Drawing of clamp for holding driving wheel tires on the table of a boring mill

to form a handle. The cam is pivoted on the pin *D* which moves in the arc shown, gripping the tire, which is laid flange side up. The block *E* is adjusted to bring it to the center of the tire and is secured by a set screw. When properly adjusted the tire will balance in a horizontal position which provides safety as well as speed in handling.

Kinks for the blacksmith shop

Descriptions of some of the shop devices brought out at the last Blacksmith's convention

MANY of those attending the last annual convention of the International Railroad Master Blacksmiths' Association, which was held at the Hotel Winton, Cleveland, Ohio, August 18 to 20, 1925, brought sketches of blacksmith shop kinks and fixtures with them. These sketches were posted on the walls of the convention hall and attracted considerable attention. The *Railway Mechanical Engineer* is indebted to a number of the members of the Master Blacksmiths' Association for their co-operation in obtaining complete information relative to the fixtures described in this article and also to the secretary, Wm. J. Mayer, for the drawings, photographs and sketches.

Tool for welding spring bands

Fig. 1 shows a tool for welding spring bands under a steam hammer. The base of this tool is a forging 5 in. thick and about 18 in. long by 20 in. wide. It contains a recess about 2 in. deep so as to admit four 3-in. blocks as shown in the illustration. These blocks form a pocket in which the band is placed while being welded. The band comes to the hammer bent to the shape shown at

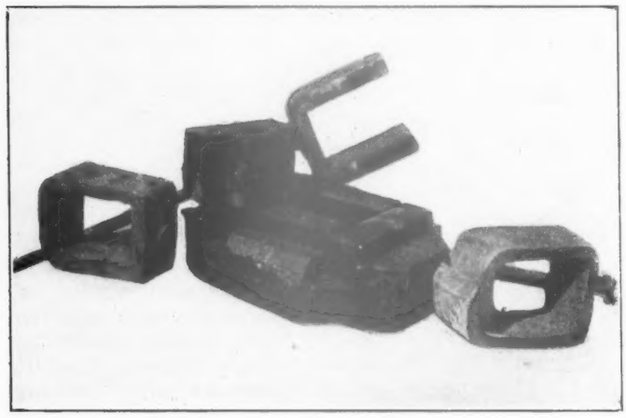


Fig. 1—Tool for welding spring bands under a steam hammer

the right of the illustration. The tee-shaped block, shown resting on the base, is placed inside the band which has been placed in the recess of the base with the part to be welded at the top. The projection of the inside block extends down about 2 in. into the recess with the horizontal arms of the tee resting on the two side blocks. The legs of the U-shaped piece, which is provided with a handle and is held by the operator, fit on the outside of the band and rest on the inside block. This prevents the sides of the band from spreading while being welded. Spring bands can be welded with this fixture, forming a boss with a tool held under the hammer; at the same time if desired, as fast as they can be heated.

Forging spring hangers for passenger cars

The dies and formers shown in Fig. 2 are designed for making spring hangers on a 4-in. Ajax forging machine. The hanger comes to the forging machine as shown at the top of the sketch. The jaws of each are heated and shaped with the headers shown at the left of the sketch. A feature in the construction of the header used for this job is the groove at the end which leaves a bead at the base of the jaws where the two parts of the hanger are welded together. This tends to give additional strength to the weld by filling up the recess which is usually left between the two halves at this point. A

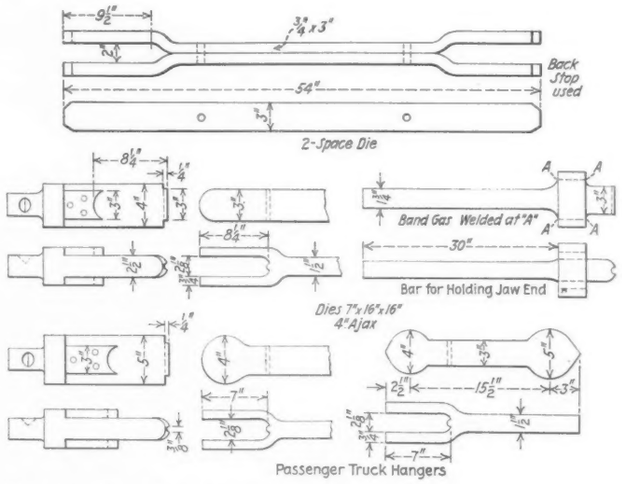


Fig. 2—Sketch showing dies and formers for making spring hangers for passenger cars

bar for holding one end of the hanger while the other end is being forged is also shown in the sketch. This bar has a ring welded to the end which fits over the outside of the jaws while the end is shaped to fit snugly inside the jaws.

Manufacturing spring hangers and reclaiming brake hangers

The dies and formers shown in Fig. 3 are being used successfully in the blacksmith shop of a large western railroad for manufacturing spring hangers and reclaiming brake hangers. The spring hanger is brought to the forging machine as shown at the top of the sketch. The header for forming the ends has a groove which forms a bead at the division between the patch and the body part of the hanger. The filet can be formed to suit the thickness of the patch by setting the back stop and shoving the hanger ahead in the die.

Brake hangers usually come to the blacksmith shop with the holes worn out of round. These can be reclaimed by heating, placing a plug of the proper diameter in the hole as shown in the sketch at the lower left of the figure, and forming the ends by means of the header shown at the lower right. This job is performed on a 2½-in. bolt header. The die shown at the bottom of the figure is used for shaping the remaining curved portion of the ends.

Punch for irregular cutting and die for making battery box hinges

Frequently the blacksmith shop is asked to perform jobs requiring the cutting of holes or notches of irregular

shape. The punch shown at the top of Fig. 4 has been designed for this sort of work. It is used on a 2½-in. double punch and shear. The leg of the punch moves

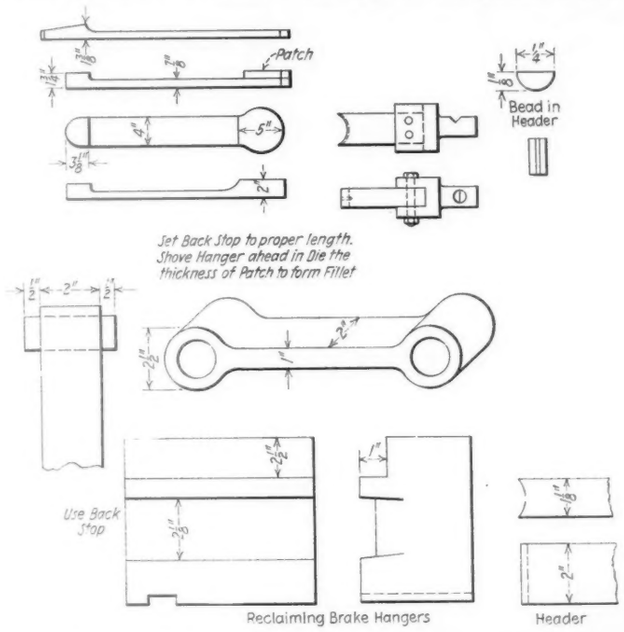

Patch
Bead in Header
Set Back Stop to proper length. Shove Hanger ahead in Die the thickness of Patch to form Fillet
Use Back Stop
Reclaiming Brake Hangers
Header

Fig. 3—Dies and formers for manufacturing spring hangers and reclaiming brake hangers on a forging machine

up and down in the die shown in the upper right hand corner of the sketch, only the cutting portion of the punch

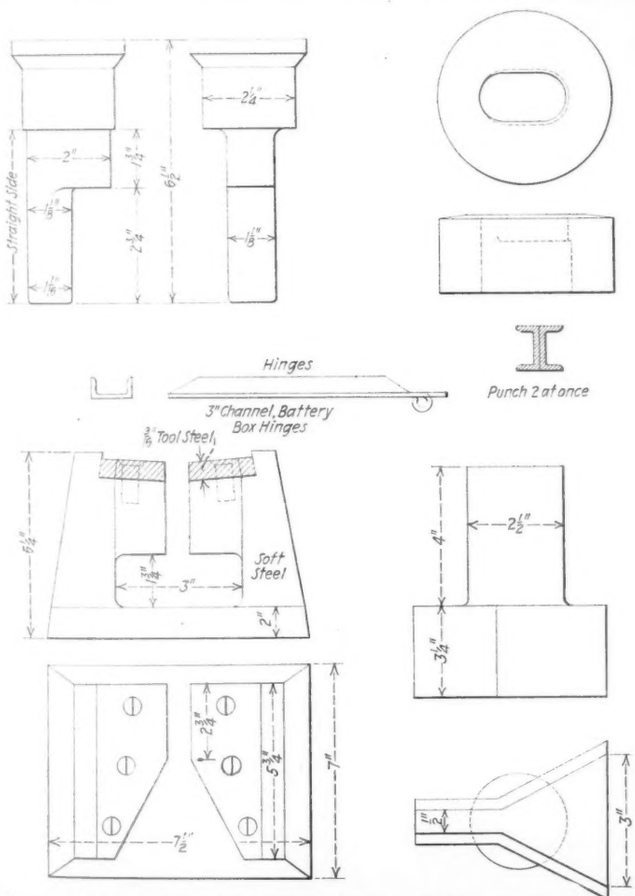


Fig. 4—Sketch showing a punch for irregular cutting and die for making battery box hinges

clearing the top of the die sufficiently for the work to be pushed against the leg of the punch.

The die shown at the bottom of Fig. 4 is designed for cutting battery box hinges from 3-in. channels. The hinges are formed in the die, the female portion of which is shown at the lower left and the male portion at the lower right of the sketch. The die trims the flanges of two channels at a time, as shown in the sketch of the hinge, and the loop for the hinge pin is formed in another operation.

Manufacturing small locomotive parts on the forging machine

The set of dies shown in Fig. 5 is used in the blacksmith shop of an eastern railroad. Die No. 1 is used for forging grease cup caps on a 3-in. forging machine, die No. 2 is used for making cylinder cock valve stems on a 2-in. forging machine and die No. 3 is used for making enginemen's hammers out of 1½-in. round steel, also on a 2-in. forging machine. Dies Nos. 4 and 5 are used for forging ash pan shaker levers and cradle pins, respectively, on a 3-in. forging machine. Steam chest relief valves and trailing truck adjusting rods are forged in

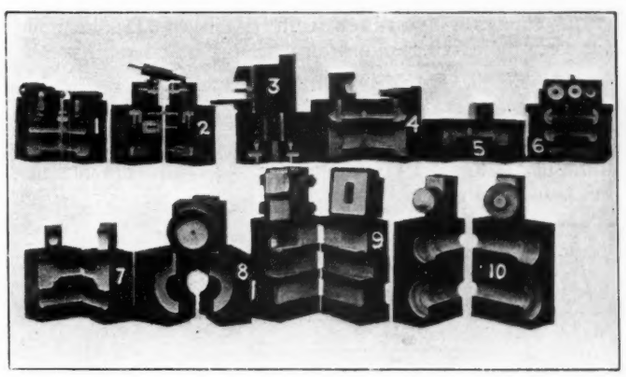


Fig. 5—Set of dies for forging miscellaneous locomotive parts

dies Nos. 6 and 7, respectively, on a 3-in. forging machine. Die No. 8 is used for forging collars on car axles on a 5-in. forging machine. It is made in different sizes to suit each A. R. A. size of journal. Spring plank hangers for steel passenger cars having Commonwealth trucks are forged in die No. 9, and die No. 10 is used for making ash pan and smoke box diaphragm studs. Both of these dies are used on a 5-in. forging machine. The studs are cut from bar stock and the slot is punched in the same heat. The die shown setting on top of die No. 10 is used for forging crank pin washers on a 5-in. forging machine.

Making steel bushings for side and main rods

The dies shown in Fig. 6 are used for making steel bushings for side and main rods on locomotives having floating bushings. This fixture is designed to be used on a 5,000-lb. steam hammer. The blanks from which the bushings are made are 6 in. thick by 11¾ in. in diameter and are cut from scrap axles. The blank is placed on top of the block *C* under the die guide No. 1, shown in the sketch. The plug *A* is then placed in position, as shown, and is driven down to form the bushing. The driving down of the plug *A* forces the metal up between the sides of the plug *A* and the die. After this operation the plug *A* is removed from the top and the die is moved back to let the plug *C* drop out. The sleeve *D* is then placed in the bottom of the hammer die, guide No. 2 is placed on the top of the bushing and the punch *B* is driven through the center of the bushing. Upon the completion of this operation the die is turned over and the various

parts are allowed to drop out. Both of these operations are performed in one heat. The third operation consists of heating the bushings and expanding them to suit the

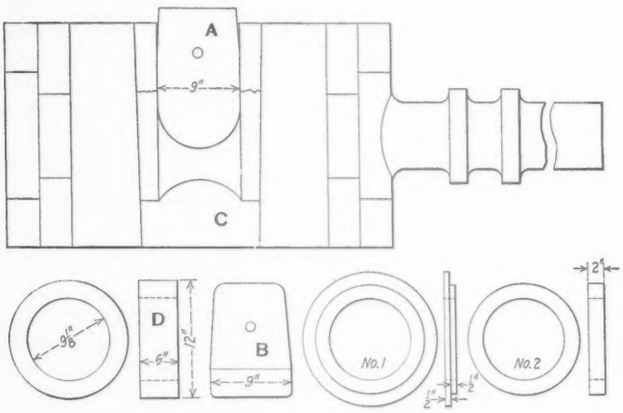


Fig. 6—Sketch showing dies for making side and main rod bushings

various classes which range from 9½ in. to 11½ in. inside diameter, by driving mandrels through the bushings.

Forging clinker hooks

Fig. 7 shows a sketch of a die for forging clinker hooks on a 4-in. forging machine. The jaw end of the handle bar is upset and punched on a 2½-in. bolt machine. The handles may be formed on a bulldozer or with a

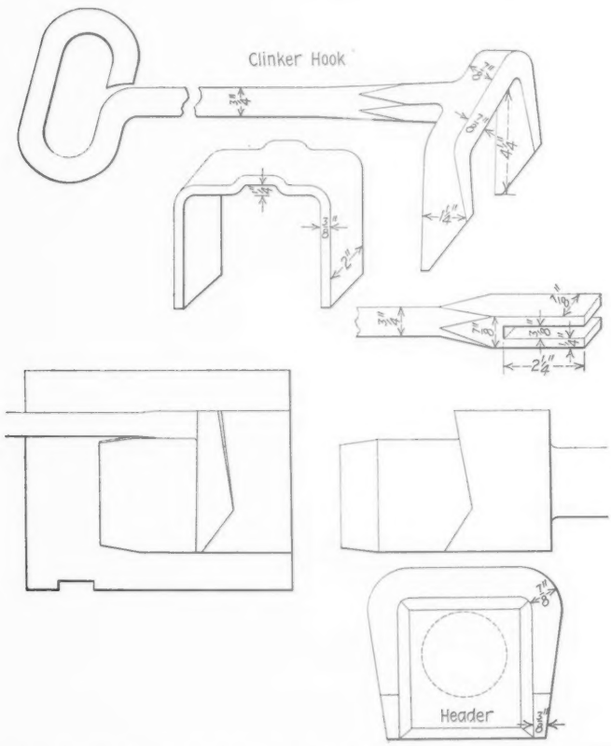


Fig. 7—A die for forming clinker hooks on a four-inch forging machine

jig on a bolt or forging machine. The hook is bent from a 2-in. by ⅜-in. flat iron on a bulldozer and the handle bar jaw is welded to the top of the hook. The hook is formed in the die, as shown in the sketch, with one stroke of the 4-in. forging machine.

A handy set of dies, swedges and stamping tools

Shown in Fig. 8 is a miscellaneous assortment of dies, swedges and stamping tools that are being used by the blacksmith department of an eastern railroad. Referring to the illustration, the joint group of tools shown on the left in the top row is a set of swedging and stamping tools for making cylinder push rods; the second group is a set of formers for bending pilot frames; the third group is a set of dies for forging switch feet on a 3-in. forging machine; the fourth group is a die, the female part of

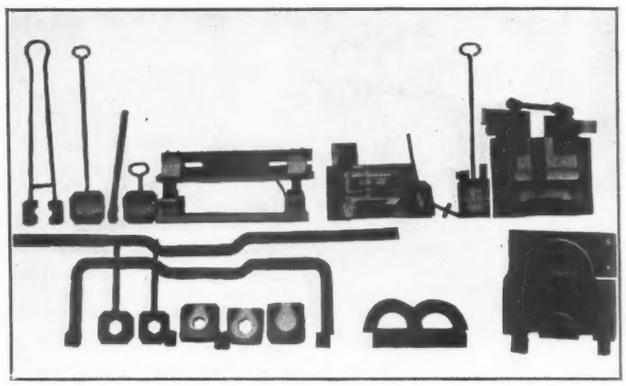


Fig. 8—A set of swedges, dies and stamping tools

which is shown leaning against the switch feet dies, or making ½-in., ¾-in., ⅞-in., 1-in., and 1¼-in. spring hanger gib seats. This die is designed for use on a power hammer. The last group of the top row is a set of dies for forging link lifters.

In the bottom row of the illustration, the first group is a set of tools for forming knuckle and wrist pin wrenches and the last group, shown at the right, is a die for punching out hub liners from boiler plates on a bulldozer.

Making coupler yokes

The sketch shown in Fig. 9 is a fixture for making coupler yokes on a bulldozer having a capacity for a 19-in. stroke. The jaws *B*, bolted to the face plate *A*, have

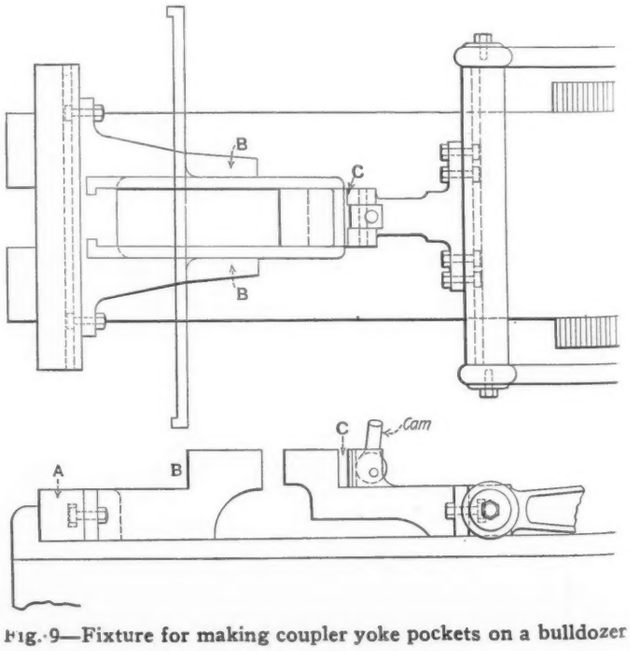


Fig. 9—Fixture for making coupler yoke pockets on a bulldozer

lugs on the ends, the inside corners of which are curved as shown. The ram is moved forward between the jaws and the piece from which the coupler yoke is bent is placed in the vise *C* of the header. After the piece is centered it is clamped in place by the cam which is pivoted in the rear of the header fixture. The coupler yoke is formed on the return stroke of the bulldozer, the ends being bent parallel to each other by the curved lugs on the jaws of the face plate fixture. The piece is heated at the center only.

Former for bending sway chain hooks

The former shown in Fig. 11 is designed for bending sway chain hooks. The female dies are made of axle steel and the male die of wrought or open hearth steel. An assembly drawing of the former is shown in the upper left corner of the figure. The eye of the hook and the point is made in the usual manner. The former is used for bending the hook to its final shape. This insures hooks of standard dimensions and speeds up production by eliminating the time required in calipering the hook for proper dimensions.

Formers for bending suspension brackets for car lighting generators

The formers shown in Fig. 10 are designed for bending center suspension brackets used for suspending car lighting generators under passenger cars. The brackets are made of spring steel. Referring to the drawing, the first operation consists of punching the holes and cutting the slot on an 18-in. double punch and shear. The second operation consists of bending the loop for the hinge pin.

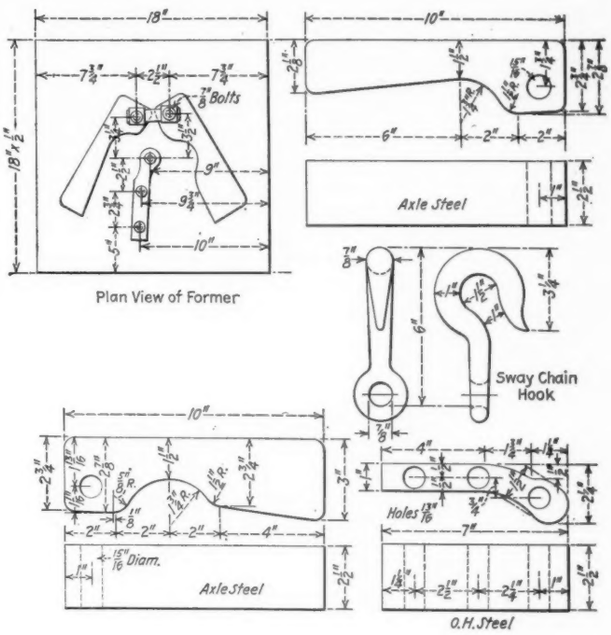


Fig. 11—Former for bending sway chain hooks

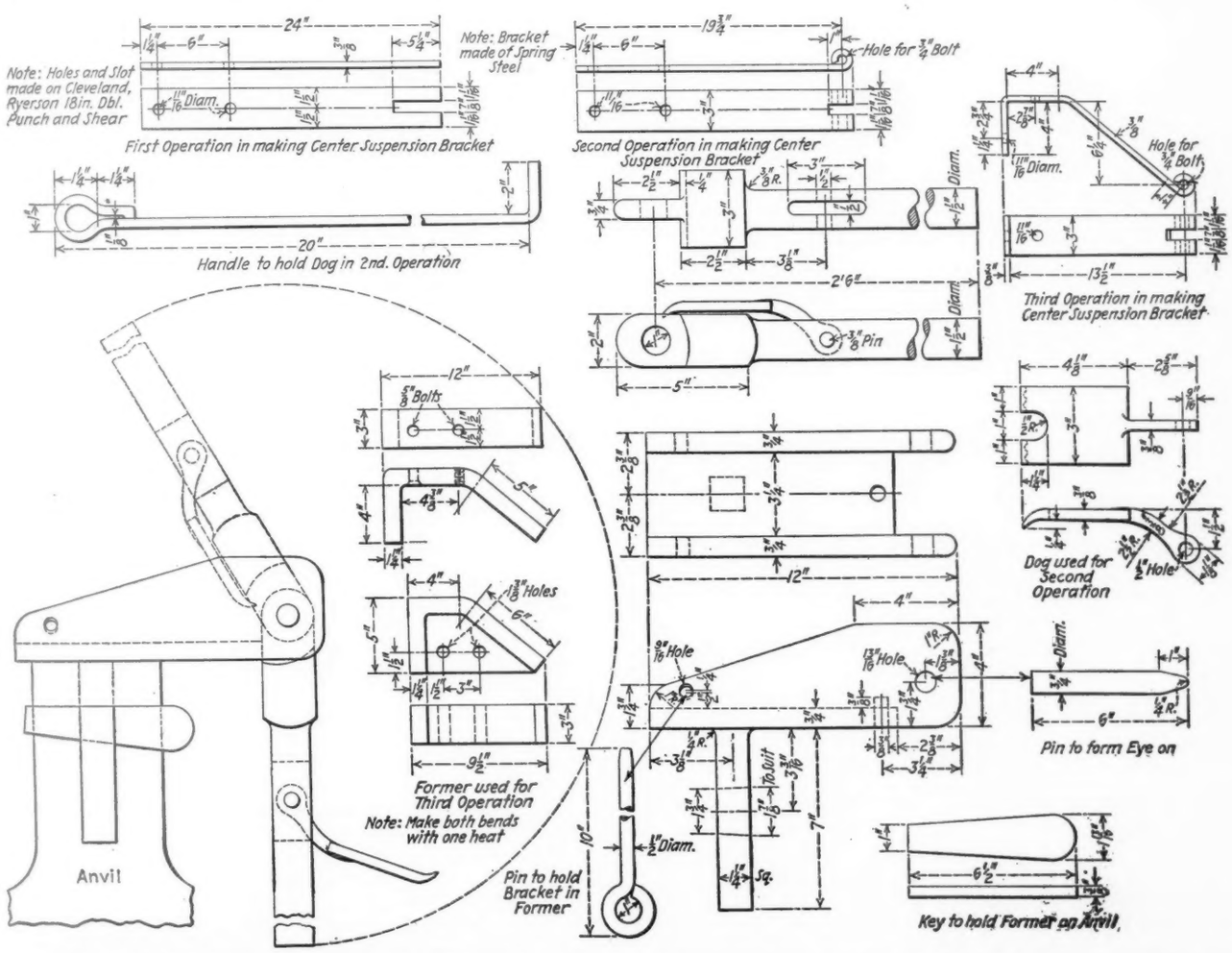

Note: Holes and Slot made on Cleveland, Ryerson 18in. Dbl. Punch and Shear
Note: Bracket made of Spring Steel
First Operation in making Center Suspension Bracket
Handle to hold Dog in 2nd. Operation
Second Operation in making Center Suspension Bracket
Hole for ¾" Bolt
Third Operation in making Center Suspension Bracket
Dog used for Second Operation
Pin to form Eye on
Former used for Third Operation
Note: Make both bends with one heat
Pin to hold Bracket in Former
Anvil
Key to hold Former on Anvil

Fig. 10—Drawing showing a set of formers for bending center suspension brackets for car lighting generators

The former shown in the lower right center of the drawing is placed on the anvil, as shown in the assembly drawing at the lower left, and is held in place with a key. The bracket is placed in the former and the ends from which the hinge pin loops are formed are bent back by placing the end of the dog over the ends of the bracket which form the hinge pin loop and the ends are bent over as the handle is moved up, as shown by the dotted line. The third operation consists of bending the bracket to its final shape, as shown in the upper right hand corner of the drawing, in the die shown in the drawing. Both bends are made with one heat.

Former for bending S-hooks

Fig. 12 is a drawing of a former for bending S-hooks from 5/16-in. bar iron. The former consists essentially of two parts; a stationary base, and a part which revolves on the base. The latter is fitted with two handles so that

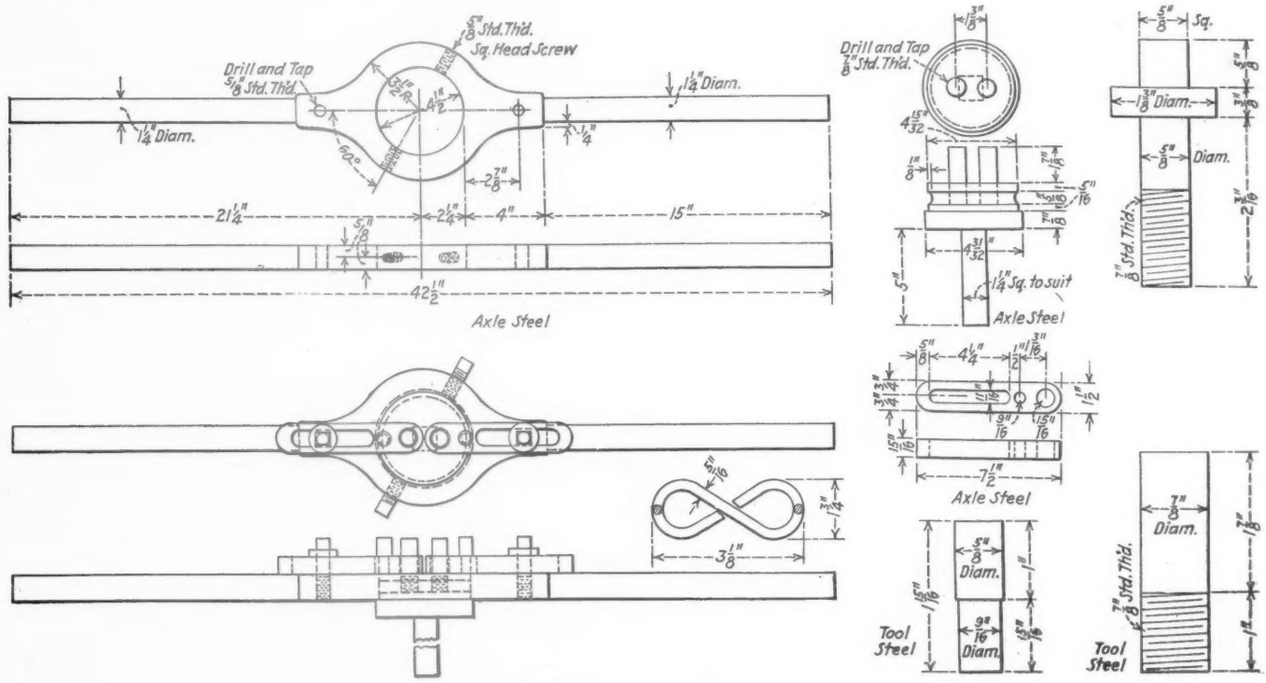


Fig. 12—Former for bending S hooks

it can be rotated by the blacksmith. The two outer pins rotate as the handles are turned while the two center pins, screwed in the base, remain stationary. The outer pins can be adjusted by loosening the 5/8-in. bolts and moving the slotted pieces, in which they are set, as desired. The hook is formed by placing a straight piece of 5/16-in. bar iron of the proper length between the two outer pins. As the handles are turned the outer pins twist the bar around the center pins until the hook is formed.

Use of safety cards reduces accidents

A CARD system has been devised by Robert W. Wray, master mechanic of the Williamsport Division of the Pennsylvania, Renovo, Pa., which puts the "safety first" proposition strictly up to each individual workman. Remarkable results have been achieved by the use of this system in the Renovo shops as is shown by the fact that an 85.7 per cent reduction in accidents for the last 26 days of October has been brought about, as compared with the same period in October, one year ago. Last year's report showed that 42 accidents had occurred at Renovo and but six during the same period for this year.

The system is such that each workman is held personally responsible for his adherence to the safety regulations. Each man is provided with a card of a size to permit of its being carried in the vest pocket. On one side, spaces are provided for the date, the employee's name, occupation, and the name of the person observing the violation of the rules. On the reverse side is the name and address of the master mechanic. A certain number of these cards are given to the foreman, gang foreman and safety committeeman. If an employee is actually violating a safety rule, such as working at an emery wheel and not wearing goggles, chipping without goggles, cutting steam hose without shutting off the steam, etc., a card is filled out and given to him to sign. The card is also signed by the employee observing the violation of the safety rules. This card is then turned into the office to be filed.

Should three cards be turned in against one man, a red card similar in form to the white card, is attached and the four cards are given to the master mechanic. The employee is then called to the office or the master mechanic goes into the shop, talks to the employee and warns him that on receipt of another card on which his name appears, disciplinary action will be taken. It is reported that the men in the shops are beginning to have considerable respect for the safety rules, since their names are liable to appear in connection with a violation. Since October 1, 1925, a total of 111 cards have been returned to the office, all of which are concrete cases of violations. Up to the present time, however, there have been no cards turned in showing the same man's name a second time for violation of safety rules.

The Interstate Commerce Commission has denied the petition of the New York, New Haven & Hartford for modification of its second train control order, except insofar as to make the effective date July 18, 1926, instead of February 1.

Methods of increasing output in small machine shops

Sketches and work orders important factors in the economical production of small parts

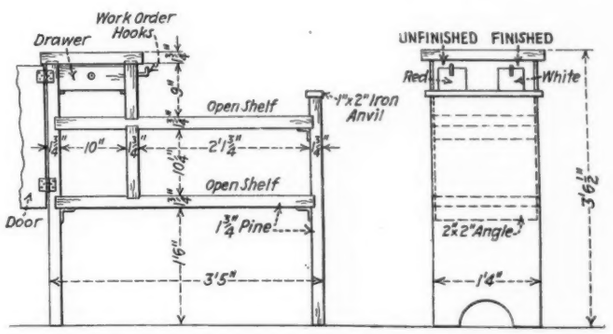
By R. B. Robinson
Atlantic Coast Line, High Springs, Fla.

A MACHINE shop large enough to require the service of a supervisor is not too small for the application of systematic methods. With this thought in mind systematic methods have been applied in these shops, which have assisted greatly in putting the work on an economical basis. In order to obtain such results in a small shop it is essential to arrange the shop fixtures for the convenience of the movement of materials and to facilitate the work of cleaning up; to prepare complete data sheets and charts, arranged in condensed form for quick reference, and to put into use a combined work order and sketch form for distribution of work including running repairs and stock work. After having done this, the supervisor will be relieved of a great deal of work that would otherwise result from the presence of useless material and confusion. He can then apply himself to refining his system of operation.

It is not uncommon practice in small shops for each machinist to secure, in some way, from time to time, a bench or box for his tools and work, selected according to his own belief as to his requirements. The result is a heterogeneous array of stands, lockers, nooks and corners, catch-alls for scrap and for material that can not be found when most needed, causing confusion and loss of time.

To make the necessary correction it becomes important, therefore, to formulate some definite plan of arrangement of the shop equipment as well as a system of work distribution. This suggests a uniform design of cabinets for the machinists, provided with places for work and lockers for tools. Such a machinist cabinet is shown in one of the illustrations. On the end of the cabinet are two places for files, one on a red field and the other on a white field. The red file is for orders of work to be done, arranged in the sequence required and marked "Unfinished work." The white file is used for order forms when the work is completed and is marked "Completed work."

While this performance might appear to be rather an exacting requirement for a small shop, it means the elimination of the usual ceremony in the morning of distributing the day's work, the preliminary distribution having already been arranged on the "unfinished work" file by the time and work signal has sounded.



Machine operator's bench and locker

To further increase production and eliminate the possibilities of errors, sketches or drawings were made of the small locomotive parts turned out in this shop. Some of these sketches are shown in the accompanying illustrations. The introduction of sketches was confusing for a while on account of the inability of the machinists to read them, but after some instruction, the sketches were understood. As a result, in a short time, we had a gang of machinists who are able to read sketches and blue prints, and who are thoroughly trained to this system of work distribution, performing their work in a straightforward manner without confusion.

It was surprising to learn of the number of good me-

ENG. NUMBER	ENG. CLASS	STEAM-SUP. HT. OR SAT.	CYLINDER SIZE-NOMINAL	PATT. NOS. OF SIDE ROD BRASSES: FRONT	BACK	INTM.	MAIN	KNUCKLE	ECCENTRIC R.	PATT. NOS. OF MAIN ROD BRASSES: FRONT	BACK	PISTON ROD	VALVE STEM	SIZE OF MET. PACKING	DRIVING BOXES-PATT. NO.: MAIN	OTHERS	CROWN BRASSES-PATT. NO.: MAIN	OTHERS	DRIVING BOX CELLARS-PATT. NO.: MAIN	OTHERS	DRIVING BOX SHOES-PATT. NO.: MAIN	FRONT	BACK	DRIVING BOX WEDGE-PATT. NO.: MAIN	FRONT	BACK	ENG. TRUCK BOX-PATT. NO.	ENG. TRUCK BRASS-PATT. NO.	TRAILER TRUCK CELLAR-PATT. NO.	TRAILER TRUCK CELLAR-PATT. NO.	TRAILER TRUCK BOX-PATT. NO.	TRAILER TRUCK BRASS-PATT. NO.	REMARKS
721	L	S.H.	22 30	J-43	J-43	I-43	B-52	G-43	K-43	L-53	A-140	3¾	2	K-33	J-33	I-38	G-38	S-31	Z-31	S-72	H-72	K-72	S-71	H-71	O-71	J-50	P-39	O-32	R-23	R-25	W-39		
722	L-1	S.H.	22 30	J-43	J-43	I-43	B-52	A-43	K-43	P-53	B-140	3½	2	K-33	J-33	M-38	H-38	P-31	S-31	P-72	I-72	K-72	P-71	H-71	S-71	K-50	P-39	N-32	L-23	S-25	W-39		
723	L-2	S.H.	22 30	J-43	J-43	F-43	P-52	L-43	K-43	L-53	N-140	3¾	1¾	K-33	S-33	N-38	G-38	S-31	Z-31	S-72	H-72	K-72	S-71	H-71	O-71	N-50	P-39	O-32	R-23	R-25	W-39		
724	L	S.H.	22 30	J-43	J-43	B-43	B-52	G-43	K-43	L-53	A-140	3½	2	K-33	S-33	I-38	G-38	S-31	Z-31	S-72	H-72	K-72	P-71	H-71	S-71	K-50	P-39	N-32	L-23	S-25	W-3		

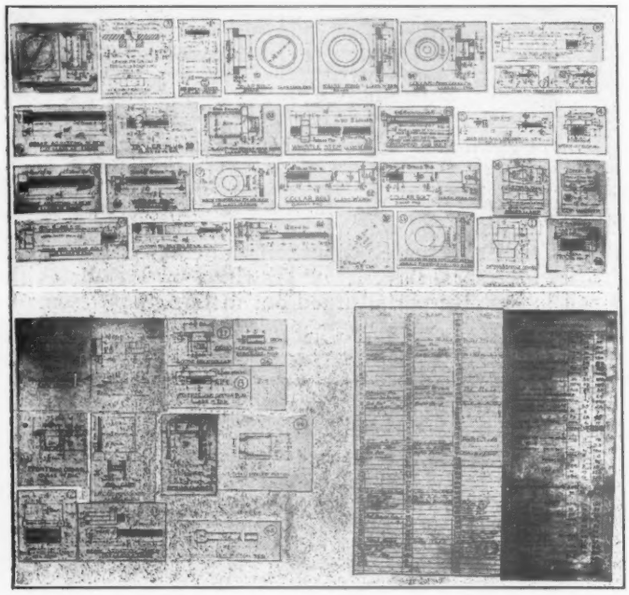
Machinist's data sheet which contains important dimensions and pattern numbers of castings most frequently renewed

chanics who were unable to read drawings. Therefore, as a result of the experience gained in the training of the machinists to carry out written orders with sketches, the writer is now arranging for a short course of instruction in pencil drawing and sketching of parts for those under his supervision.

In order that every one may become familiar with the work turned out at this shop there is kept under glass duplicates of standard drawings of repair parts most commonly made in the machine shop. Also, there are pencil sketches covering pieces used locally as standard but which have not been sketched and tabulated on standard drawings.

These drawings and sketches are made sufficiently small to be convenient for easy reference. They each bear a sketch and bin number so that in making up stock, the machinist is simply referred to the sketch by number for dimensions. The repairmen, too, have fallen into the habit of making use of the frame of detailed drawings in locating bins containing parts wanted. Helpers and others not conversant with the names of these parts, also find these drawings an aid in locating material bins.

The stock in the bins is machined largely by the apprentices. In fact, they are generally required to keep these bins in order and to replenish them when the stock is depleted. In such cases the sketch, with the written work order, has the merit of eliminating time losses incurred by having to stop a machinist who may be machining or repairing a part, in order to explain to the apprentice the work to be done on some of these stock parts.



The top view shows how the sketches are grouped together for ready reference, while the lower view shows a few more sketches as well as at the right, a chart showing the material bin numbers and their contents, and at the extreme right an index to the material chart which gives the name of the piece, class of locomotive used on, sketch sheet number and bin number

The system, in addition to eliminating interruptions in the progress of the work, leaves no excuse for loafing. It furnishes a means also of checking up on the man who would "stall" or lacks the spirit of sincerity in his work. In having the work to continue in this definite systematic way, there is an advantage of keeping in touch at all times with the progress of operation of each piece under way, and with the line up that follows.

In the small shop with limited equipment, where the distribution of work must of necessity be rearranged as incoming running repairs develop, the method proves very satisfactory. The foreman merely rearranges the order of the work slips according to the erecting shop or engine-house requirements.

In addition to locomotive repair part sketches, the individual locomotive data sheet shown in the illustration is of much service to the machinist. It contains the dimensions to which the parts designated on the data sheet are to be finished, thus eliminating the practice of the operator leaving his machine to secure dimensions. Another illustration shows a condensed tabulation of castings with their pattern numbers as well as certain characteristics of all classes of locomotives. Where many classes are used, the compilation of such a condensed table is rather tedious. However, the frequent use to which it is put makes the time spent fully worth while.

LOCOMOTIVE DATA SHEET

ENGINE NO. | CLASS | SUPHT. OR SAT.

SIDE ROD BUSHINGS

LOCATION	SIZE OF BORE		OUTSIDE DIA.		LENGTH		THK. OF COLLAR		PATT NO.
	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	
FRONT									
BACK									
MAIN									
INT'M									
FRT. K.P.									
BACK K.P.									
ECC. ROD									

MAIN ROD BRASSES

	SIZE OF BORE		OVER ALL WIDTH		STRAP WIDTH		HEIGHT		LENGTH		PATT NO.
	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	
FRONT											
BACK											

PISTON ROD				VALVE STEM				CYLINDER	
DIA. OF ROD		NOMINAL SZ. PKNG.		DIA. OF STEM		NOM'L SIZE PKNG.		BORE SIZE	
RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT	LEFT

OTHER DATA

This data sheet is filled out and given to the machinist as a guide for making repairs

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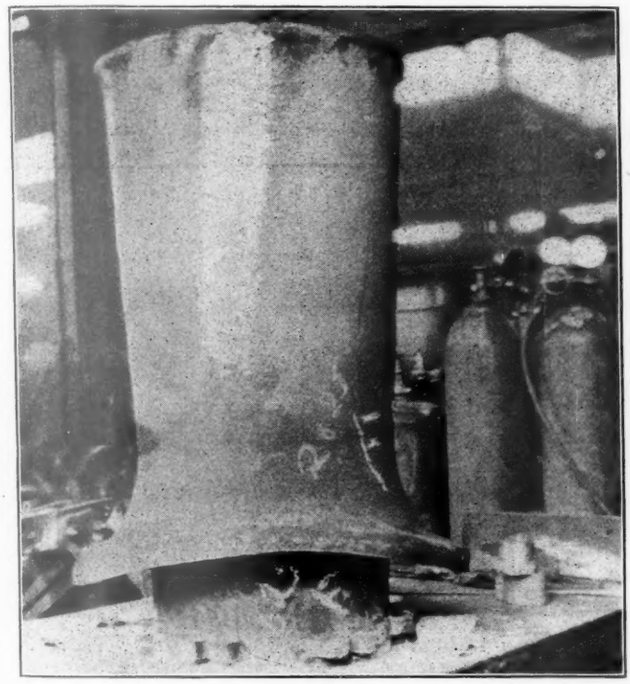
Iron and wood floors in railway wagons may be replaced by cement, if experiments recently conducted in Germany continue to prove successful. According to a report by the United States Consul-General at Frankfort-on-Main, a reinforced concrete composition has been used in the construction of the floors of railway cars with a great measure of success. The first car made of this substance was built in 1919 at Heidelberg, and was tested in the railway yards. The car withstood concussion at a speed of 16.5 miles, and shifting tests were so satisfactory that after five years of service, this test car still remains in perfect condition. The new type of car weighs 20 tons and in appearance is much the same as an ordinary iron one. The cost of manufacture, however, is much less than for iron, and although the concrete car is much heavier, the fact that the danger of rust is eliminated offsets this disadvantage. The car with concrete floor requires so little repair work in comparison with wood and iron cars that the railway administration is favorably impressed since the yearly expenditure for repairs on the old type of car reaches a considerable amount. A company for the manufacture of these cars has been formed at Darmstadt.

Welding with Tobin bronze

Use of a mild heat facilitates making welds on cast iron— No pre-heating is required

MANY railroad shops have been using Tobin bronze quite extensively during the past few years for welding locomotive parts that would require dismantling if any other kind of welding rod was used. This development in welding work has created considerable discussion as to the merits of Tobin bronze as compared to cast iron and steel. The Wabash has performed a number of successful repair jobs in its shops, photographs of some of which are used to illustrate this article. The American Welding Society has devoted considerable attention to the development of Tobin bronze welding and a number of papers have been presented on that subject before various sectional meetings of the society during the past year. Following is an abstract of a paper presented by S. W. Miller, consulting engineer, Union Carbon and Carbide Research Laboratories, New York, before the December, 1924, meeting of the Boston, Mass., section.



Smoke Stack welded with Tobin bronze to avoid preheating

Welding cast iron with bronze

By S. W. Miller

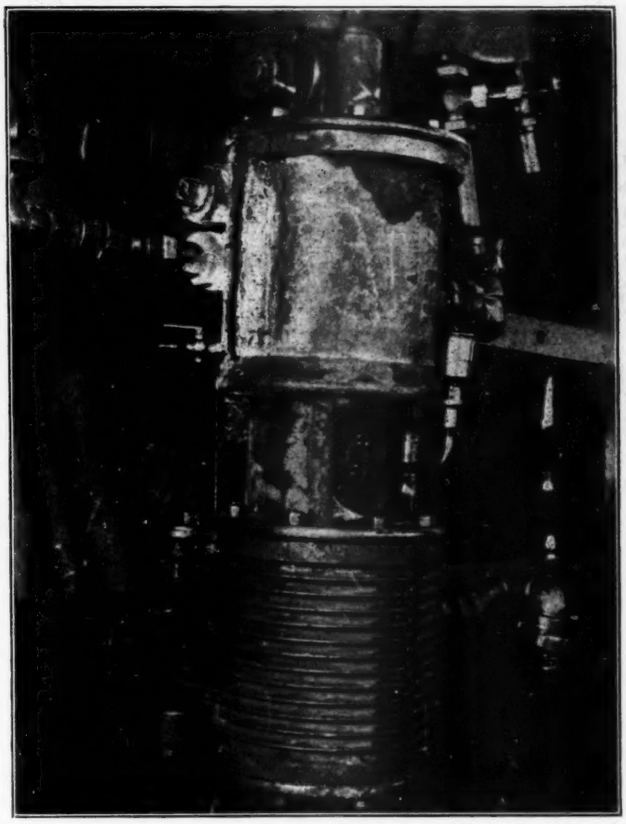
Consulting engineer, Union Carbon & Carbide Research Laboratories, New York

At first sight, welding cast iron with bronze does not seem to be a very promising process. The softness of bronze compared with that of cast iron and the quite general belief that bronze is deficient in strength, would lead one to believe that the chances for success were comparatively small. But, when we consider the facts we can easily see that there are good reasons for the success and wide application of this method used for joining cast iron.

The bronze used for this purpose is not real bronze. It is not a copper-tin alloy, but a copper-zinc alloy. Furthermore, it is not ordinary brass, but contains iron, manganese and tin, varying amounts of one or more of these elements being present. The composition usually falls in the following range:

Copper	57 to 62 per cent
Zinc	38 to 41 per cent
Iron	up to 1.0 per cent
Manganese	up to 0.5 per cent
Tin	up to 1.0 per cent

From this it will be seen that the composition must be restricted rather closely. The iron strengthens the alloy, the manganese helps in making a sound weld, while the tin increases the fluidity. It is essential that aluminum and lead be kept out as the former prevents the bronze from joining with the cast iron, while the lead makes a porous weld.



Air compressor welded with Tobin bronze without being removed from the locomotive—The break was vertical to the steam passage to the left of the casting

The advantages of the bronze welding processes are: First, its rapidity; second, only a small amount of preheating need be used; third, the ductility of the bronze absorbs and reduces to a safe point welding strains that would cause breakage with cast iron welding; fourth, the greater strength of the bronze makes it possible to use

only small amounts when the weld design is correct; fifth, the low melting point of the bronze and its easy union with the cast iron, makes it possible to apply without melting the base metal.

Its only disadvantage is its ductility or rather its low yield point, which makes it unsuitable for use where rigidity is needed. Even in such cases it is sometimes possible to use bronze if the unit stress is not too great. It may also be said that different alloys used for bronze welding rods have different shaped stress-strain curves, some of them having a rather definite yield point, as does steel. Such alloys behave in an elastic manner and acquire no permanent set under safe loads.

The uses to which the bronze welding process may be put may be divided into two classes: where stress is needed, and where a bearing surface must be provided.

The usual method of fusion welding requires a vee between the pieces joined. This is gradually filled up with the weld metal which is fused to the sides of the vee during welding. Thus, the strength of the welded piece depends on the strength of the union between the weld and base metals. Where bronze is vee-welded to ordinary cast iron and the joint is tested in tension, the break is always in the cast iron because it is the weaker. This is, of course, where the sections are equal. Any defect in the union makes the joint less efficient. It is also evident that when the vee is filled up, the maximum tensile strength is obtained. It is possible, however, to make a joint always of greater strength than the cast iron by using the shearing strength of the union between the two metals. There is no limit to the length of the weld so the shearing strength may be made anything desired. The tensile strength depends on the thickness of the weld and this can easily be made ample.

Welding with Tobin bronze on the Wabash

By James A. Heaton
Welding supervisor, Wabash, Decatur, Ill.

Before Tobin bronze was used in railroad shops, it was customary to weld all iron castings with cast iron welding rods. This usually required dismantling of the part to be welded so that it could be pre-heated. This was necessary, for when welding with cast iron, the base metal had to be raised to fusion heat so that the base and weld metals would be completely welded together. It is still considered good practice to weld many castings in this manner, despite the time and trouble required to dismount and pre-heat them. There are, however, some castings on a locomotive which can be satisfactorily welded in position without dismounting or removing the internal part.

This class of work is shown in the two illustrations of the air pumps. In one case, the break occurred in the steam cylinder in the rear of the casting. In repairing this break, the pump was removed from the brackets and placed on the running board of the locomotive. The break was chipped out and all the metal within two inches of the break was thoroughly cleaned. The steam line was then attached to the pump and allowed to remain open for 20 minutes, when the steam was shut off. Welding with Tobin bronze filler rods was begun immediately; a total of 10 minutes being required to complete the weld. The Tobin bronze welding rods, heated and dipped in powdered flux, were used to "tin" the surface of the cast iron with bronze. The bronze flows freely and spreads out over the clean metal surface forming a thin film. After the "tinning" process was completed, the bronze was built up until the break was completely filled, care being taken to manipulate the torch so that neither the cast iron or the bronze were overheated.

In such work the base metal must not become too hot, but should become sufficiently heated so that the bronze will run freely and adhere to it. It should be kept in mind that the melting temperature of Tobin bronze is approximately 1,650 deg. F., while that of cast iron is about 2,300 deg. F. After the work of welding was completed, the pump was allowed to cool down to the temperature of the steam. The steam was again turned into the pump for about 20 minutes after which time the pipe was disconnected and the pump replaced on the brackets ready for service. The entire time consumed on this job was 1 hr. 20 min. So far as the work of welding was concerned,

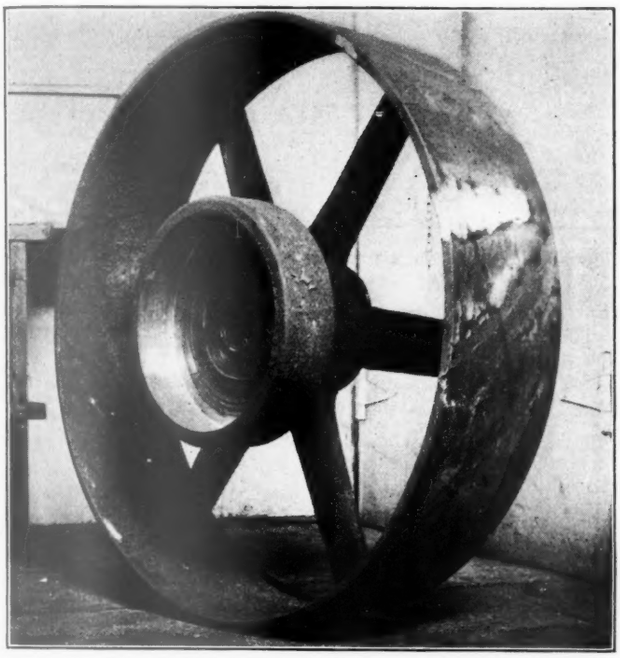
In repairing a break in the steam cylinder at the rear of the casting, this air compressor was removed from the brackets and placed on the running board

it would have been unnecessary to remove the pump from the brackets except that the break occurred in the rear of the pump where it was inaccessible.

The second pump which is also shown in one of the illustrations was repaired without being removed from the brackets. The break was vertical at the steam passage to the left of the casting. The welding work on this job was performed in practically the same manner as described for the first pump.

Another repair job performed with Tobin bronze filler rods is the 36-in. cast iron pulley, views of which are shown in two of the illustrations. The width across the face of this pulley is 10 in. The broken piece in the rim was 18 in. in length on one side and 12 in. on the other.

There was also a break in the center of the broken piece extending three-quarters of the distance cross the face. There were, therefore, three breaks to be welded. This job could have been accomplished with cast iron filler rods but this would have required pre-heating. The edges of the broken part of the rim of the wheel were beveled to an angle of 90 deg. An opening of about ⅛ in. was left to allow for expansion. Plates were placed on the inside and held in position by means of clamps as shown in one of the illustrations. These clamps held the broken part in line with the rim during the process of welding. The break in the center of the base was not beveled or expanded in any way until the welds at each end had been completed.



A 36-in. cast iron pulley welded with Tobin bronze—The broken piece in the rim was 18 in. long on one side and 12 in. on the other, with a crack in the center extending three-fourths of the distance across the face

After welding the two end breaks, the casting was allowed to cool down and it was found that the center break had opened one inch further. The center break was chipped out to an angle of 90 deg. and welded with Tobin bronze. The casting was then allowed to cool and the welds were ground with a portable emery wheel to the coutour of the rim.

This job was completed in six hours including the work of welding and the time required for cooling. One man performed all of the work. If this job had been done with cast iron filler rods, it would have taken this time properly to pre-heat the pulley and two men would have been required to complete the work.

Another example of bronze welding is shown in the illustration of the smoke stack. This job did not involve the removal of parts, but the object in welding with Tobin bronze was to avoid pre-heating. The smoke stack which was badly cracked could have been welded just as well on the locomotive. But, as the locomotive had come into the shop for classified repairs, it was necessary to remove the stack. If the welding had been done while the stack was on the locomotive, an additional advantage would have been gained, because, the work could have been done while the fire was in the boiler and the heat would have kept the stack casting from cooling too rapidly. As it was, the casting was removed and placed on a work table as shown in the illustration. The break was beveled to 90 deg. and the metal cleaned off two inches on either side. A 3/16-in. or ¼-in. diameter Tobin bronze filler rod, 36-in. in length is the best adapted to this kind of work. The flux was applied by heating the bronze rod, dipping it into the flux box and applying the flux coated rod in the weld. The flux used in this case was a good grade of brazing flux in the form of a powder.

The term "brazing" is often applied to this operation, but bronze welding is believed to be a better term. If a Tobin bronze weld is cut open with a saw, the weld metal will be found to have mingled with the base metal, producing a union between the two. When this condition exists, the term "welding" seems to apply more accurately than the term "brazing." As an illustration a shaving 32 ft. long was taken from a piston head that had been welded with Tobin bronze. This shaving did not show any blow holes or porosity and returned to its original shape when stretched.

Owing to its high tensile strength, and its ability to withstand strain with heavy loads, Tobin bronze is being used quite extensively in these shops on machine parts such as rebuilding gear teeth, broken chucks and repairing tools. In a locomotive shop where taps are used by nearly everyone, regardless of whether or not they understand how to use them, the wrench fit will be worn round or the taps sometimes broken when not reversed to allow the cut metal to drop out of the teeth. To offset this difficulty, an extension of mild steel is brazed on the tap. When an extra strain is given the tap, this extension will twist which indicates to the operator that something is wrong. The writer has seen extensions which have twisted off leaving the brazing intact.

Our experience on the Wabash has shown that the average cast iron welder needs a little special training in the handling of Tobin bronze, in order to accomplish good work, particularly where the weld is vertical.

Welding with Tobin bronze *

By W. C. Swift

Research engineer, Anaconda Copper Mining Company, New York

When one stops to compare the processes of welding with Tobin bronze and welding with steel or cast iron, it is soon evident that the two processes have little in common other than the preliminary careful cleaning of the weld areas of the base material. In welding with Tobin bronze, it is absolutely essential that the mill scale on rolled or drawn steel, unless rusted away, should be ground or filed off. It is advisable to apply the heat a little back from the joint and let it flow evenly to the entire surface of the vee, taking care that the weld areas are not heated at any time above a dull red. A good flux should be used and in making a large Tobin bronze weld, the weld areas should be "tinned" with the Tobin bronze, and bronze then added to complete the weld. It is essential that the cone of the oxy-acetylene flame be kept away from the Tobin bronze, otherwise the bronze will burn quickly and weaken the weld.

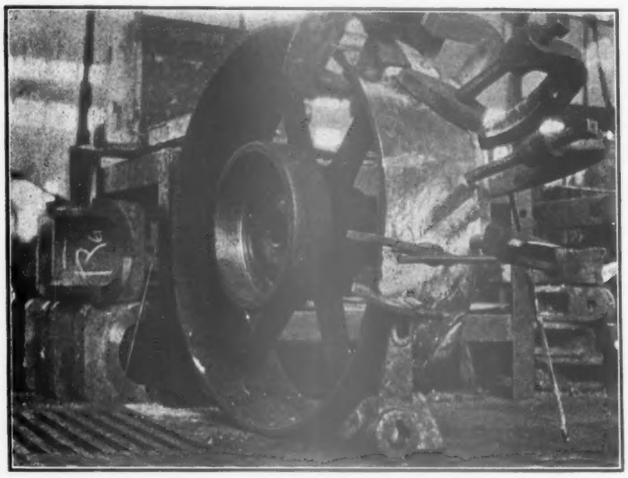
Welding with steel and cast iron is based on the principle of fusion of the weld areas with the base material. Welding with Tobin bronze is based on the principle of surface alloying a fused dissimilar filler material with the base materials which are heated to a dull red only. The reader will note that these principles are different in each essential respect and that is the reason why one meets so many welders who tell you they have tried to weld with

*Abstract of paper presented at the May, 1925, meeting of the New York section of the American Welding Society.

Tobin bronze but have had no success. The reason they have had no success is that they have tried to weld with Tobin bronze just exactly as they would weld with steel or cast iron. It can not be done.

It is becoming quite common in railroad repair shops to weld locomotive cylinders in place with Tobin bronze. As Toben bronze is about three times as strong as cast iron, it is possible to use proportionately less of the bronze. Anything breaks at its weak spot, so if the weak spot can be made three times as strong as at first, it is a great advantage. Furthermore, if the weld can be made without pre-heating and in one-third or less the usual time and have a joint three times as strong and one that will not rust, why not weld with Tobin bronze?

Steel can be welded with Tobin bronze in about one-half to one-fourth the time required to make a weld with



Another view of the 36-in. cast iron pulley, showing how the clamps were applied to hold the broken part in line while being welded

steel. The Tobin bronze weld is as strong as the steel weld; there is no injury to the base metal and little, if any, warping or pulling out of line.

In welding galvanized iron with Tobin bronze, welds are made very rapidly with no burning of the galvanized coating; the welds will not rust and are practically non-corrosive. Practically every article, except aluminum, brought to a welding shop can be welded with Tobin bronze.

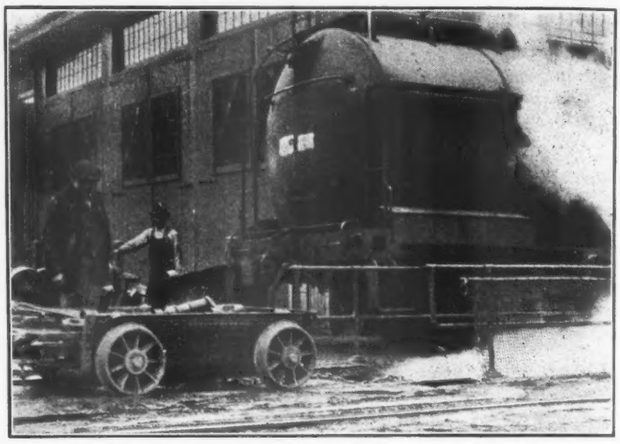
Welding electrically with phosphor bronze is making rapid progress and the developments of the future seem to promise almost as great advantages for this process as have been proved in welding by the oxy-acetylene process with Tobin bronze.

Lye pit for cleaning locomotive parts

By Charles W. Geiger

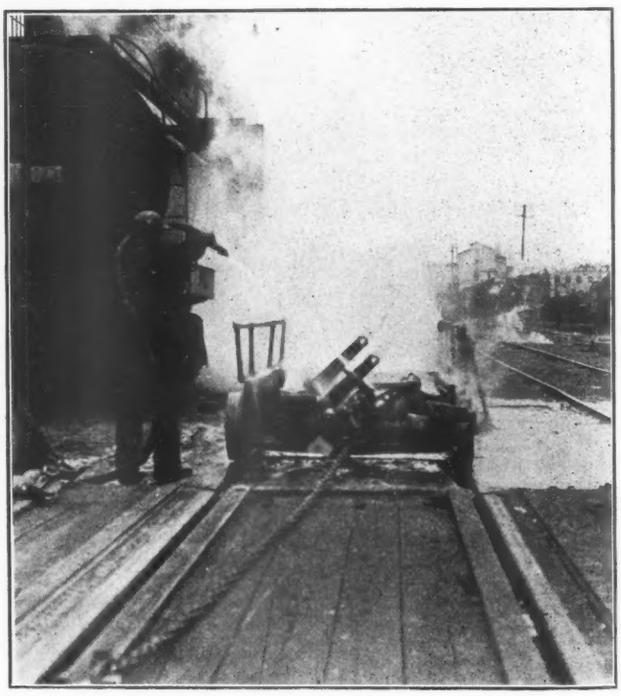
THE lye pit illustrated is located at the general repair shops of the Southern Pacific, Sacramento, California. It is constructed so that the top of the pit is level with the shop tracks and is provided with hand rails on both sides. The parts to be cleaned are placed in a four-wheel truck equipped with a steel body, which is punched with holes so that the lye water is drained off when the truck is pulled from the pit.

The system used for cleaning locomotive parts in these shops is quite simple and efficient. The truck is placed, adjacent to the locomotive in the erecting shop and as each part to be cleaned is removed it is placed in the truck. After this work is completed, the loaded truck is pushed onto the transfer table which takes it to the track leading to the lye pit. The end of the lye pit toward the



View showing the truck standing at the top of the incline leading into the lye pit

transfer table is built with an incline and the track runs directly down the incline to the bottom of the pit. The loaded truck is pushed off the transfer table and is attached to a cable as shown in the illustration. It is then



The truck load of parts is removed from the pit by means of a cable attached to the drum of the transfer table

pushed to the top of the incline and allowed to run down to the bottom of the pit.

After the parts have been submerged in the hot solution for the required period the truck is then pulled up the incline out of the pit by attaching the cable to the drum cable of the transfer table. The solution is heated by steam pipes installed in the pit. After the truckload of parts has been removed from the pit a workman washes them off with a stream of water.

The Reader's Page

Have You a Question? Ask it
Have You an Opinion? Express it

Laying out crown brasses

PORT ARTHUR, Ont.

TO THE EDITOR:

After the press fit has been turned on a driving box crown brass, the two edges must be laid out preparatory to machining to fit the driving box. The method we use is to stand the new brass on end on the driving box and line it up, as near as possible, with the end contour of the box. The lines are then scribed on the end of the brass with a scriber held flat against the lip on the driving box. This method is very unsatisfactory because of the great variation in the pressure required to press the brasses in the boxes.

I would like to receive some suggestions as to a more accurate method of laying out these brasses.

A CONSTANT READER.

Apprentices neglected

HAMMOND, Ind.

TO THE EDITOR:

The writer has always felt a keen interest in railroad apprenticeship systems and has read carefully all the articles to which he has had access dealing with the training of railroad apprentices.

Observation of methods of handling the apprenticeship question on a number of roads leads one to believe that some are making an honest effort to benefit themselves by training apprentices in four years' time to become skilled mechanics and later graduating to be officers.

On other roads it seems that they have apprentices simply because their craft agreements permit a certain quota of apprentices. Such apprentices are often treated as in the nature of a necessary evil rather than as an asset—a well trained apprentice is surely an asset to any railway.

I recall one large system that provided night schools with capable instructors for the benefit of the shop apprentices. Another system, equally as well known, turned the boys loose to the tender mercies of a mechanic. Would it be hard to hazard a guess as to which railroad turns out a graduate at the end of four years of the most value to itself and to the boy?

Another large system maintained at a number of shop points, for the special benefit of car department apprentices, several tracks on which the apprentices, under the direction of a skilled supervisor, rebuilt wrecked cars of various types, making templates and patterns from drawings, thus securing good practical knowledge of car construction and a working knowledge in reading blue prints.

Still another road gives the apprentices four hours' instruction per week in mechanical drawing and arithmetic. It has been noticed that in the grading, which is done jointly by the apprentice instructor and shop foreman, very often the boy who grades high on shop work is low in school work, and vice versa. I have often wondered if this was caused by trying to fit "a round peg into a square hole."

Nearly all agreements with shop crafts covering the employment of apprentices have "aptitude" clauses stating that, "If after a specified period of time the apprentice shows no aptitude for the work, he shall be dismissed." This rule should be more carefully observed and strictly enforced. An examination covering the apprentice's inclination to learn, his fitness for the work, and his desirability from the company's viewpoint, should be given, and if the boy fails, he should make way for another.

Frequently the foreman does not place the boy with a mechanic possessing the class or temperament of an instructor. It is seldom "the blind can lead the blind" and it is injustice to place an apprentice with an inferior or temperamental mechanic and expect to attain results.

H. R. RICE.

College men in the mechanical department

STATE COLLEGE, Pa.

TO THE EDITOR:

In your February issue, the leading editorial under the above caption discusses briefly, but to the point, a question which is uppermost alike in the minds of railroad officers and college teachers and administrators. The next step would seem to be to bring together representatives of each of the parties concerned.

May I suggest the following for consideration?

1—Set aside a session at the June meeting of the Mechanical Division of the American Railway Association, for a carefully prepared survey of the present situation. Let the men chosen for this task be familiar with both angles of the question. These papers should present an analysis of the problem rather than give a general discussion.

2—Follow this with an open discussion in which all the cards are laid on the table. At least 25 representative heads of railway mechanical departments, and deans should be invited to attend.

3—Appoint a joint committee before the meeting or early in the proceedings which should meet during the convention and report back before adjournment. If possible, they should prepare a definite working plan for both the colleges and the railroads, to meet present needs.

4—Give the plan a fair trial for two years, and based on the experience of the proposals, prepare a more permanent program.

If, this, or a better plan is not carried out, there is grave danger that the railroads will continue to lose some of the best engineering graduates.

In venturing to suggest the above definite plan, it is assumed that the railroads are not satisfied with present conditions. Unless sufficient attention is given to a better understanding, no adequate solution may be expected.

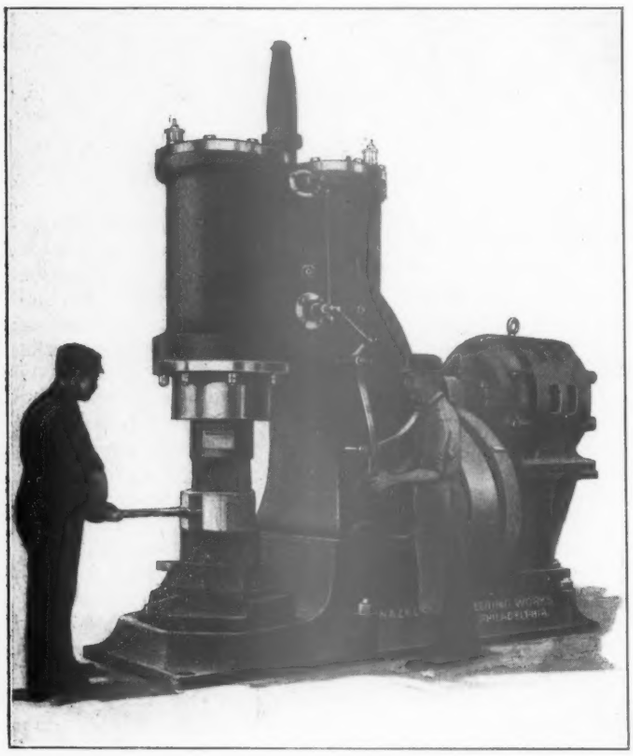
From my contact with many railroad men and with hundreds of mechanical graduates, I regret to observe that the gap is growing wider, and it will not be bridged until both sides get together and agree on questions of recruiting and training.

The engineering schools are now waiting to see if the railroads are sufficiently interested to co-operate actively.

A. J. WOOD,
Head, Department of Mechanical Engineering,
The Pennsylvania State College.

Self-contained air operated forging hammer

A SELF-CONTAINED air operated forging hammer has been placed on the market by the Nazel Engineering & Machine Works, 4041 N. Fifth street, Philadelphia, Pa. It is a combined hammer and compressor which uses the air at the temperature which it attains in compression, and as its expansion is almost perfect, it gives up nearly the full power that is put into it in compression.

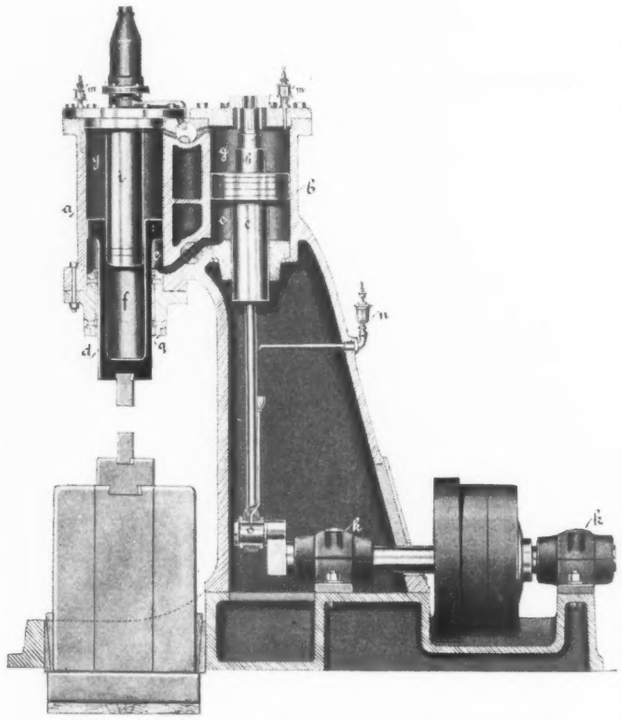


Type B motor driven, air operated, hammer with a ram stroke of 27¾ in.

There are two separate cylinders, cast integral, one in which the piston operates, actuated by a connecting rod attached to the crankshaft, which in turn, revolves with each revolution of the belt or a motor driven fly wheel. In the other, the ram or hammer head, sliding vertically on closely fitted guides, is operated by compressed air and vacuum influenced by the double acting piston in the opposite cylinder.

The ram or hammer head is a hollow forging of special alloy steel, bored out of the solid and in nowise attached to any other part of the hammer.

Special importance is placed on the longest possible ram guide, which is fitted with cast iron shoes on which the ram or hammer head slides. These shoes can be easily removed or relocated in several positions 45 deg. apart, should it be desired to change forging position of dies. This feature applies to the Type B hammers only, as Types N and I are fitted with adjustable V guides.

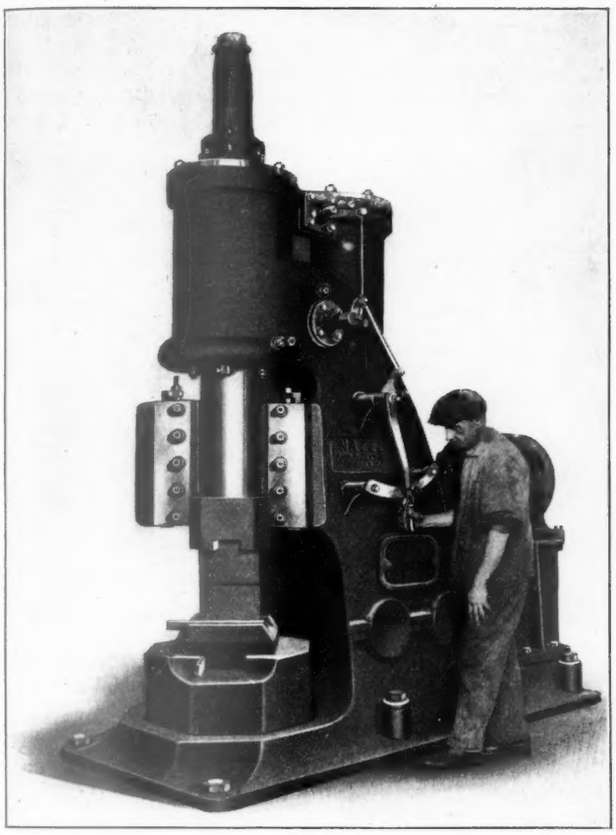


Cross-sectional view showing the construction and method of operating the Nazel air operated hammer

The base plate is cast in one piece and is secured to

the cylinder frame or housing by four weldless steel rings shrunk on accurately machined bosses, on the housing and base.

The anvil block is made of a special grade of grey iron and is separate from the hammer frame and base and rests independently on the foundation. The diagonal



Nazel Type N motor driven, air operated, hammer built with 500 lb., 700 lb. and 1,250 lb. ram weights

position renders the dies accessible on all sides and enables long bars to be worked in either direction across the anvil.

The anvil cap or bolster is a steel casting, keyed to the anvil block above the base plate and it can be removed without disturbing the hammer. The dies are regularly furnished with flat faces for plain forging and are made of high carbon, open-hearth, steel forgings.

The Nazel hammer is controlled by two simple cylindrical valves which are operated together. After the power is turned on and the valves closed, the ram elevates and remains stationary in a suspended position, allowing free space for the operator to place the work on the lower die. When the valves are opened by means of a treadle or hand-lever, the ram begins to operate. If the valves are opened suddenly, the ram will strike a quick, hard blow. If opened gently, it will strike a light blow, the force of the blow being increased as the valves are opened further.

The method of operation and construction of the hammer can be followed by referring to the cross-sectional view in the accompanying illustration. By lowering the piston *C* the ram *D* is forced upward by the force of compressed air in chamber *E* of the ram cylinder underneath the top of the ram and by the vacuum produced by the descending piston in the chamber *G* above the ram. It is to be noted that two forces act jointly in the raising of the ram. As the piston *C* ascends, the suspended ram *D* is driven down by the force of the compressed air in chamber *G* above the ram and the vacuum in the chamber *E* underneath the top of the ram. These two forces are augmented by the compression in the inner ram chamber *F* which is created by the force of the ascending ram.

The hammer starts immediately as soon as the power is turned on and maintains a uniform speed at all times, variable blows being obtained instantly at the will of the operator without interruption or adjustments of any kind.

The hammer can be belt driven irrespective of the direction of rotation and the belt shifter is interchangeable to either side of the hammer. As the load is of a fluctuating nature, it is desirable that the drive should be as direct as possible. For this reason the hammers are equipped with a tight and loose pulley, thus eliminating the use of countershafts. As the drive must be capable of transmitting the maximum power given under the specifications covering the respective size of hammers, it is recommended that the double belting be used.

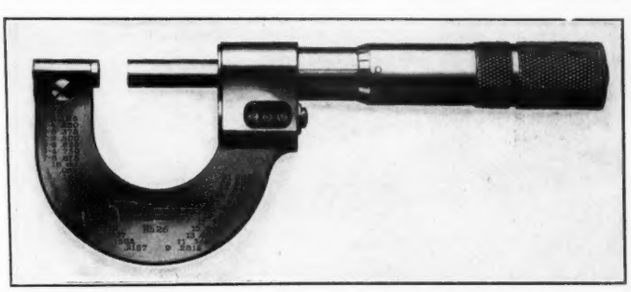
The hammers are also arranged for motor drive, either geared or belted and may be obtained complete with the motor. Any type of constant speed motor can be used but the speeds should be under rather than over those specified so as to permit the use of as large a pulley as possible.

Direct reading micrometer caliper

READING the setting an ordinary micrometer has always been more or less difficult because all the .001-in. marks on the barrel can not be seen at one time and these marks are necessarily so small that under adverse lighting conditions they cannot be seen easily. These conditions are more or less conducive to errors in making a reading. The Brown & Sharpe Manufacturing Company have recently placed on the market a micrometer on which the setting can be read directly from a dial.

The construction of the micrometer is substantial throughout. Particular attention has been given to the indexing mechanism to insure long life and dependability. Steel indexing gears are used, insuring good wearing qualities and smooth action.

The micrometer can be easily held and operated with one hand. The dials are large and can be read at a glance from any angle. Simple means for the adjustment of the measuring screw are provided. When it is necessary



Micrometer caliper which can be read at a glance

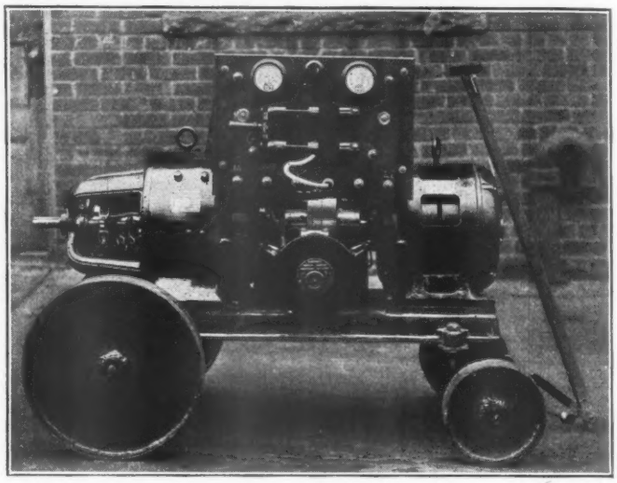
to compensate for the wear of the measuring screw, a cap on the end of the thimble is removed and the adjusting nut is accessible through an opening in the thimble. This construction is advantageous as it is not necessary to dissemble the tool or return it to the factory for adjustment.

Dual current welding generator

A GENERATOR designed to develop both alternating and direct current for arc welding purposes has recently been developed by the Electric Arc Cutting & Welding Company, Newark, N. J. The machine is being marketed under the name of "Dualarc" generator, and it is built by the designers to meet the demand for a single machine which will embody all of the advantages which have been attributed to both a.c. and d.c. arc welding. The entire apparatus has but one involving unit which is ball bearing and may be driven by any form of power motor, or by any available line shaft delivering from five to 7½ hp.

The entire set is guaranteed to operate continuously for all arc welding without vibration. It is possible to short circuit the generator without injury, as the voltage simply falls to a low value holding the maximum current constant. It can be left in this short circuited condition indefinitely without injury. The field coils are so arranged that they may be connected either as series compound or series differential so that both carbon arc and metallic arc requirements are provided for. The machine is not separately excited. The field windings are wound on steel bobbins and baked solid in enamel before being mounted rigidly on the poles. The poles are then mounted rigidly in the frame and disassembly can be made in the same manner.

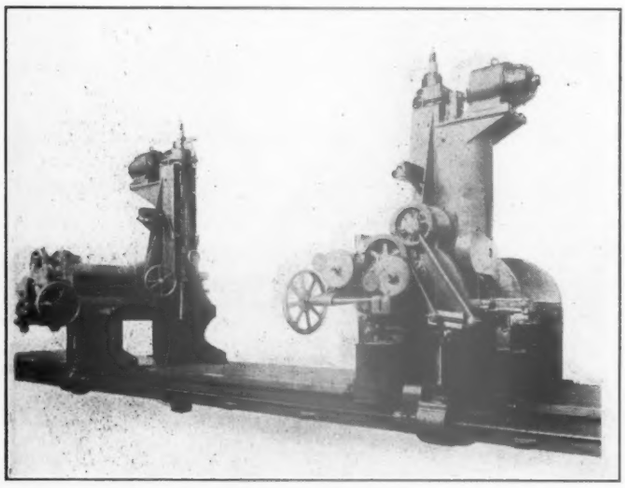
The armature is one complete baked unit with d.c. commutator and a. c. collector rings interval, each ball bearing and frame is demountable separably. There is a shaft extension on both ends of the generator so that air compressors or other power take-off can be utilized. The generator will operate in either direction and the voltage and current are adjustable independently.



Combination a. c. and d. c. welding generator equipped with motor drive and mounted on truck for portability

Two head locomotive frame slotter

THE Betts Works of the Consolidated Machine Tool Corporation, Rochester, N. Y., has recently placed on the market a line of locomotive frame slotting machines the yokes of which are driven by separate motors. The illustration shows one of these machines equipped with two heads, but they are also furnished with one or three heads, as required.



Each yoke of this locomotive frame slotter is driven by a separate motor

This machine is simple in design and construction. A minimum number of working parts are employed, full advantage being taken of electrical action for driving, feeding and traversing, instead of using mechanical means for these operations. The width between the yokes, height under the yokes, length of bed and the travel of the slotting rams are arranged to meet the special requirements of the user. The height and length of the stroke is arranged to permit the slotting of the frame in multiple.

The bed consists of a wide, deep casting with long narrow guiding surfaces for yokes. The faces on which the yokes bear, are chilled so that they have a hard smooth surface. The top is provided with suitable T-slots for clamping the work. Both sides of the bed are equipped with stationary lead-screws, the yokes are moved by means of revolving nuts which engage with them. The lead-screws have tumbler bearings which prevent sagging. The thrust is taken by roller bearings.

Each yoke has a separate electric feed and power rapid traverse along the bed, and are driven by a single motor mounted on each yoke. The yokes also have a fine hand adjustment by means of a large handwheel within the reach of the operator from the floor.

The crossrails are arranged with either a hand or power swiveling movement for angular slotting. Each saddle

has electric feed and power rapid traverse, as well as hand adjustment along the crossrail. The motor driving the feed and power rapid traverse to the yoke performs the same functions for the saddles. Both the yoke and saddle-feed may be engaged simultaneously for angular slotting. The feed is adjusted by means of graduated feed plates located conveniently for the operator and are accessible from the floor. Independent feed to yoke and saddle is provided.

Each ram is driven by a 20-hp. reversing motor with a high return speed ratio. The cutting and return speeds are independently adjustable by means of separate rheostats for each which give a wide range of speeds. Push button control for starting, stopping, reversing, inching, etc., is available for all motors.

The rams are counterbalanced by sliding weights suspended by steel cables, and are entirely self contained. They are driven through spiral bevel gears driving a rotating screw meshing with a bronze nut, with provision for taking up the wear. A mechanical knockout device is provided to prevent overtravel. The length of the stroke is determined by means of adjustable dogs which operate a master switch controlling the driving motor.

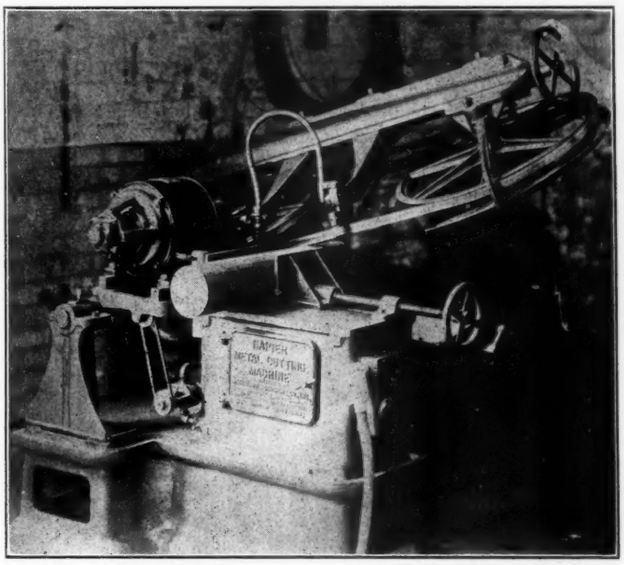
The important saddle bearings are supplied with oil by means of an adjustable automatic pump, with a feeder pipe to each bearing.

Horizontal metal cutting band saw

A CUTTING head or arm which, by its own weight feeds the saw into the work instead of the usual method of feeding the work into the saw, is the unique feature of the new metal cutting band saw, a product of the Metal Saw and Machine Company, Springfield, Mass. This action is made possible by the use of a horizontal instead of a vertical arm by the manufacturers of this machine.

The weight of the horizontal cutting head is counterbalanced by a powerful spring which gives an automatically variable feed pressure to care for the difference in the hardness in the piece of metal. It is claimed that this characteristic saves the band saw blade and gives a straight cut regardless of the variations in the stock. Constant attention from the operator is unnecessary. After the material is secured firmly in the vise and the cut started, the machine does the rest.

The accuracy and speed of the horizontal saw, which is driven by a Westinghouse motor, makes it desirable for high production in many industries for cutting all kinds of metal such as discs, billets, alloy steels, structural iron, cast iron, pipe, tubing, axles, brass, bronze, aluminum, duralumin, fibre, zinc and various other kinds of material.

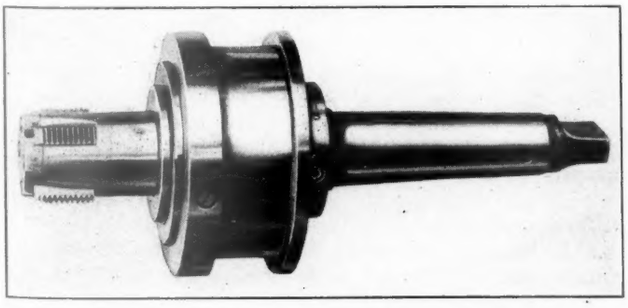


The cutting arm of horizontal Papier band saw is fed into the work by its own weight

New adjustable collapsing taps

A NEW adjustable and collapsing tap which is available in four classes, designated as S, SA, SB and SC, respectively, has recently been placed on the market by the Geometric Tool Company, New Haven, Conn.

The Class S tool, shown herewith, is of the hand machine type, having a closing handle and trip plate.



The rotary type of S B tap for automatic machines

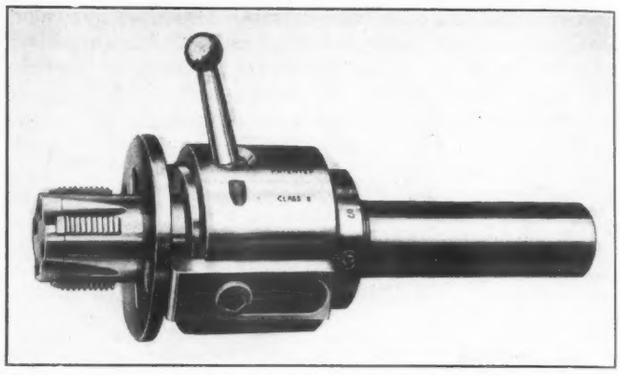
Contact with the work at the required time collapses the chasers; resetting is done by hand. The Class SA is of the rotary type with a plate trip and is the same as Class S but without the handle. Contact with the work collapses the chasers and contact of the closing sleeve resets the tap. The third class, designated as SB and also illustrated herewith, is of the rotary type with a flange trip, and is also the same as the Class S tool except that it has neither the closing handle nor the trip plate. In this tool a flange is fitted over the closing sleeve for collapsing and resetting the tap. The SC tap is of the hand trip type. It has no trip plate and is opened and reset by means of the handle.

Each of these four classes of collapsing taps is said to be convertible into the other at little or no expense. Thus, one tap with slight changes can be used on hand or automatic machines, and can be changed from plate trip to flange trip or vice versa, as well as to hand trip. The taps are made in sizes ranging from ¾ in. to 3½ in. inclusive.

The front end of the tap is of large diameter which is

claimed to increase the strength and chip clearance. Grooves milled in front of the chasers are intended to prevent the packing of chips and to permit the chasers to cut freely. The tool is of alloy steel, hardened and ground, and is enclosed for protection against dirt and chips. Another skeleton is required for left-hand tapping.

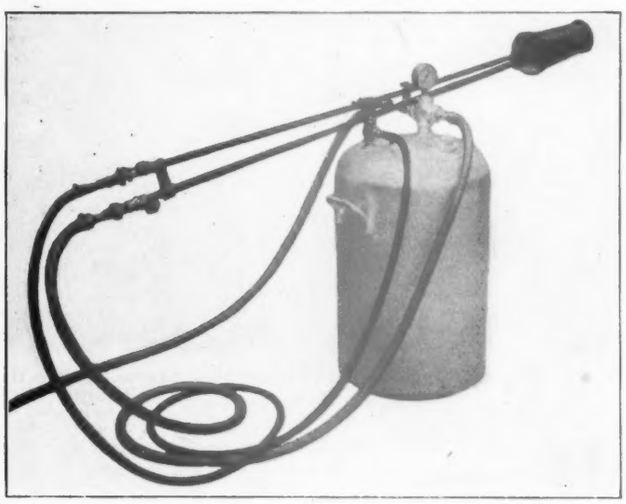
The chasers used in the four classes of S taps are interchangeable but they are not interchangeable with those used in the company's Class NL or Class H taps. The chasers are of sturdy design and because of their thickness are said to have long grinding life. Short length is a feature stressed as lending strength to the front end of the tool under the torsional stress of tapping. The chasers are of sufficient length, however, for any standard pipe thread. They are supported for their full length, which provides a bearing under the cutting point, and may be removed simply by removing the cap.



The class S tap which is the hand machine type and operated by a closing handle and trip plate

Milburn oil burner and preheater

IN welding many castings, preheating is necessary to neutralize expansions and contraction strains or to effect economy of gases. Without preheating, complicated castings are liable to develop new breaks at points remote from the weld after the weld itself has been successfully completed. Large castings will absorb a large amount of heat before local melting occurs so a great gas saving can be made by preheating the entire piece.



Oil burner and preheater which can be used for many purposes

An oil burner and preheater recently placed on the market by the Alexander Milburn Company, 1418 West Baltimore Street, Baltimore, Md., is primarily designed for this work and to give maximum combustion and greatest heat in the quickest possible time, thereby resulting in greater output from men and machinery.

The burner is of the atomizing type utilizing economically the cheapest grade of crude, fuel, kerosene oil or distillate and compressed air under pressure varying from 50 to 100 lb.

The air supply line serves two purposes. While furnishing a direct flow to the burner, the air also maintains a similar pressure in the oil storage tank, creating a greater velocity in the oil feed line thus insuring a positive and uniform flow of both oil and air.

The flow of both air and oil are through straight-line orifices, unhindered by coils or staggered passages. The oil, under pressure, enters the atomizing chamber at right angles to its axis and in an annular form, while the compressed air flows directly through the center striking the filament of oil and completely atomizing it, then expanding it in a venturi-shaped outlet. A thorough mixing vortex is thus set up, producing an intimate and perfect mixture of both oil and air which insures complete consumption and maximum heating value at the flame. No particles of fuel are blown through the flame unconsumed. There is no siphoning effect of either oil or air. Immediately upon opening the valves the gas at the burner can be ignited and the work at hand can be started. It is claimed that carbonization and oxidation are eliminated in this burner.

Ball bearing electric chain hoist

THE Yale & Towne Manufacturing Company, Stamford, Conn., has recently developed a ball bearing electric chain hoist known as Model 20B. It embodies such features as close headroom, long lift, higher speed, automatic top and bottom limit stops, and greater over-all strength. This hoist has high factors of safety in the strength of the load-supporting members and is designed to withstand shock loads so common to this class of equipment. All suspension members of the hoist are made of steel. The hoist can be quickly adapted to any overhead system. The side plates of the trolley carriage can be spaced on steel bars to fit the desired beam flange.

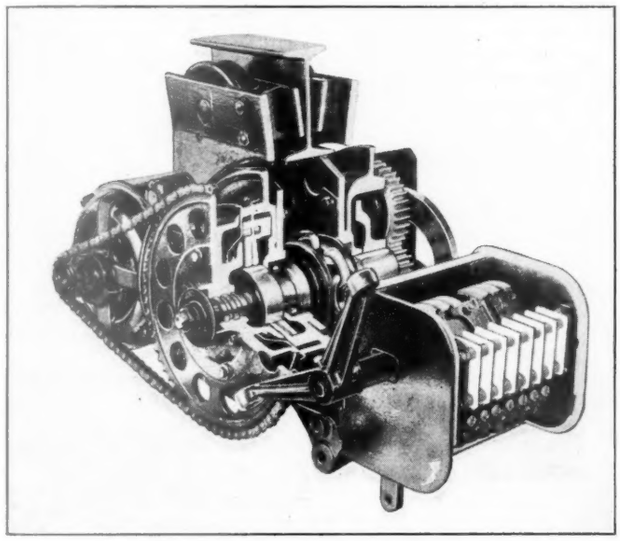
Yale electrically welded steel chain can be furnished for varying lengths of lift. The centralized steel suspension provides a constantly balanced load on the trolley wheels and hoisting unit irrespective of load position.

The mechanism is fully enclosed in oil-tight chambers and is compact and easily accessible for inspection without expert service. The large chrome vanadium steel ball bearings surrounding the steel load sheave adds a big factor for low current consumption and general all-

around hoisting efficiency. The heavy steel one-piece load sheave, ground on an arbor to give perfect concentricity for the ball races, is bronze-bushed for the driving pinion, and splash lubrication provides a continuous flow of oil over all gears, pinions and bearings. The driving pinion that passes through the load sheave is machined from a single drop forging. The bearing surfaces on the shaft are ground to .001 in.

The motor brake is operated positively by the control handle. When the current is on, the brake arms are lifted clear of the drum so that there is no dragging or friction during the hoisting operation. Immediately the current is shut off, the brake arms clamp tightly around the hoisting drum, producing a powerful, positive braking action.

The upper and lower limit safety stops are mechanically connected with the controller and operate the drum brake when the load hook has traveled its limit in either direction. The current is cut off and the brakes are applied the moment the limit of travel is reached. An upper limit stop does not in itself provide maximum safety of operation, but when combined with a lower limit stop the protection afforded is complete.



Yale ball bearing electric chain hoist with low headroom

The steel chain containers can be furnished to hold any length of slack chain up to 60 ft. for ¼, ½ and 1-ton hoists and 30 ft. for the 2-ton hoist. These containers are secured to the under frame of the hoist and do not affect the headroom.

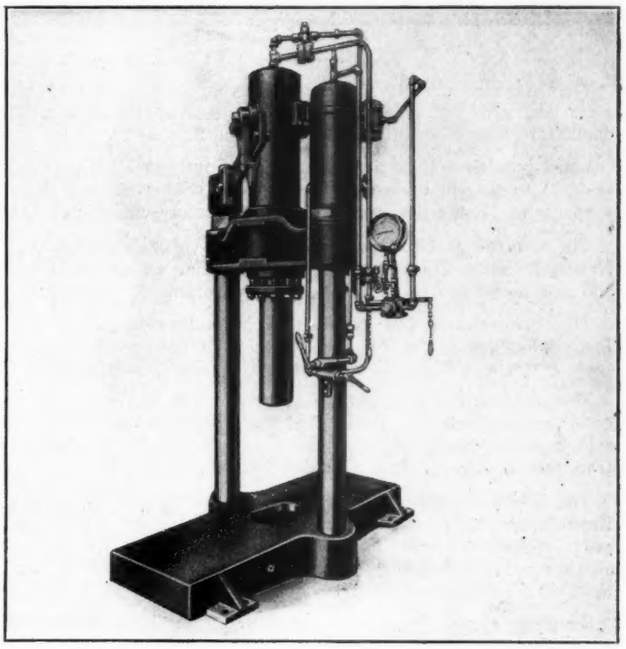
Two-rod hydro-pneumatic forcing press

A PRESS designed for operations involving forcing, pressing and bending, and adaptable more especially to railroads and other large shops has been placed on the market by the Watson-Stillman Company, 50 Church Street, New York. This press can be used for many operations of bending and straightening.

The press is of the two-rod type having the ram movement from the top downward. The ram movement is actuated by hydro-pneumatic force obtained by an air engine pump which is designed to be connected to the air line of the shop. Thus, it will be seen that the press can be operated in any shop having air pressure and does not require a motor or any other source of power.

A jib crane is provided as part of the press to facilitate handling work into and out of the press. The bottom platen is amply strong for bending with blocks on its ends up to full capacity of the press.

The valve control is simple and easily operated and a gage is provided to register in tons the pressure exerted by the ram. The press illustrated is of 100 tons capacity and the bottom platen is 72 in. long with a hole in the center to receive shafts, etc.



Watson-Stillman hydro-pneumatic 100-ton capacity forcing press

AVERAGING GOOD AND BAD YEARS.—10 to 12 per cent of all the workers in the United States, several millions of men and women, are out of work all of the time. Each year from 1,000,000 to 6,000,000 persons are out of work for weeks and sometimes for months at a time. Widespread unemployment is now a constant phenomenon with far-reaching economic, social, psychological and moral bearings. In seeking work through certain types of commercial or fee-charging employment bureaus, particularly those dealing with unskilled and casual labor, thousands of men and women are being exploited. It is claimed by the Russell Sage Foundation, New York, that public employment bureaus or exchanges can make a material contribution toward the solution of this and other phases of the ever-recurring problem of unemployment.

These are some of the points brought out in the introduction to the report of a five year study of employment methods, needs, and agencies, which has just been made public by the Russell Sage Foundation. It is brought out in the report that the figures on unemployment, while representing the average of the country's experience during the last two decades, are not necessarily indicative of present conditions or of the past year.

The investigation, which extended into more than 70 cities in 31 states and Canada, has just been completed. The full report, covering more than 600 printed pages, will be issued shortly. The survey was conducted by a staff of trained field investigators, all of whom had previously been engaged in employment work, under the direction of Shelby M. Harrison, Director of the Foundation's Department of Surveys and Exhibits.

A special study has been made of the situation in Ohio, Wisconsin, Massachusetts, and New York, where there has been the greatest development of organized public employment work.

News of the Month

PROMOTIONS AND APPOINTMENTS I.C.C. THE SUPPLY TRADE CLUB AND ASSOCIATION NEWS NEW TRADE PUBLICATIONS NEW SHOPS

The shops of the Savannah & Statesboro, at Statesboro, Ga., were destroyed by fire on February 6; estimated loss, including damage to four locomotives and one coach, $25,000.

Lapel buttons will be awarded by the Southern Pacific (Pacific system) to six employees, one from each division and the general shops, who did the best work in the 1925 safety campaign.

The Central of Georgia has awarded a contract to Joseph E. Nelson & Sons, Chicago, for the construction of an enginehouse and storehouse at Albany, Ga., to cost approximately $100,000.

The Pennsylvania has awarded a contract to Lyman S. Peck, Inc., Philadelphia, Pa., for the extension of the erecting and machine shops at Olean, N. Y., at a cost of approximately $100,000.

The Seaboard Air Line has ordered 1,000 box cars and 800 gondola cars from the Pressed Steel Car Company, 800 gondola cars from the Standard Steel Car Company and 800 gondola cars from the American Car & Foundry Company.

The South African railways will build locomotive boilers at its Bloemfontein shops to encourage local manufacture, according to press reports. Twenty-five new freight cars and 10 passenger coaches are now building at these shops, which have turned out a total of 275 freight cars and 109 coaches.

Southern Pacific division and shop employees made 4,486 safety suggestions during 1925. Of this number, 3,248 or 72 per cent were approved and put into effect by the safety committees. Of the remainder 435 were still being considered at the end of the year.

For 20 years the railways of India and the Indian railway board have been considering the question of automatic couplers for their freight vehicles, particularly on broad gage lines. The difficulty in India that has delayed a decision in this matter lies in the necessity for designing a coupler that will meet the transition stage; that is, an automatic coupler that will join up with the existing screw coupler until the latter is displaced.

The Norfolk & Western has given copies of four reels on the rough handling of freight cars and the Illinois Central has contributed 1,000 ft. of film on the proper handling of freight in the freighthouse and on the proper inspection of cars, to a library of educational motion-picture films established by the committee on freight claim prevention, Freight Claim Division, American Railway Association. The films, which are standard gage, are available to members of the division upon application to the secretary.

According to reports compiled by the Bureau of Railway Economics, the daily average movement of freight cars during the year 1925 was 28.3 miles, the highest mark ever attained by the railroads of this country since the compilation of this information was started in 1917. This was an increase of 1½ miles over the average attained in 1924 and of ½ mile above that for 1923. It also was an increase of 3.4 miles above the average for 1920.

The average load per freight car in 1925 was 27 tons, the same as that for 1924, but nine-tenths of a ton below that for 1923. Compared with 1920, the average for 1925 was a decrease of 2.3 tons.

A unique chain letter recently reached the offices of the Canadian National in Montreal. It contains an appeal for safety first, and it has visited many countries. It touched Japan, the Scandinavian countries and various parts of Canada and the United States. The letter, which bore with it a request to the recipient that it be mailed to nine friends in various parts of the world, has been in circulation for some months, apparently having been started by an American officer and already having reached the countries mentioned above. The letter warns the recipient to cross crossings cautiously, practice safety first and "do everything in my power to save a life or prevent any injury to my fellow-men."

Fuel bill for eleven months

The railroad fuel bill for the eleven months ended with November, 1925, was $300,740,376, as compared with $324,501,011 for the corresponding period of 1924, according to the Interstate Commerce Commission's monthly statement, covering fuel for road locomotives in freight and passenger train service, charged to operating expenses, for Class I roads, excluding switching and terminal companies. The average cost of coal for the period was $2.72 per ton, as compared with $3.05 in 1924, while the average cost of fuel oil per gallon increased from 2.78 cents in 1924 to 3.15 cents in 1925. For the month of November the average cost of coal was $2.63 and the average cost of fuel oil was 2.92 cents.

Vote on interchange and car service rule changes

Interchange Rule 112 of the American Railway Association, regulating prices to be used in settlement for cars damaged or destroyed, is to remain unchanged, the proposal to modify the rule so as to provide for recognition of the rebuilt car having been voted down.

Car service Rule 4, of the American Railway Association, which provides that empty cars may be short routed at five cents a mile, is the subject of a letter ballot, which has been sent out by Secretary H. J. Forster, proposing that the rate be changed to six cents a mile beginning with April 1.

A. B. & A. Credit Union

The A. B. & A. Railroad Credit Union has been organized by officers and employees of the Atlanta, Birmingham & Atlantic for the benefit of employees of this road. It is an adjunct of the benefit association which was established by these employees about three years ago. The president of the credit union is C. E. Brower, general superintendent of transportation. The secretary is George M. Gentry, Atlanta, Ga., and the chairman of the supervisory committee is Colonel B. L. Bugg receiver of the road.

The benefit association functions not only as an indemnity fund but also includes provisions for arbitration of disputes between the railway management and the employees, being a party to a joint reviewing board. This board consists of five members elected by employees and five appointed by the management. The membership of the benefit association at present is 1,700 or 85 per cent of all the persons employed on the road. It has a reserve fund of $41,000. This fund will be taken over by the credit union.

Rail motor cars on French railroads

The relative economy of gasoline over coal as motive power, when traffic is light and infrequent, has induced various experiments in the use of motors on railroads in France, beginning in 1921 with a series of trials by the État Railway, according to Commercial Attaché Jones at Paris. In the first of these experiments an attempt was made to adapt the ordinary street auto-bus of Paris to use on railroads by a simple change of wheels. Later, specially constructed cars were ordered, and trials of these began in March, 1922.

Operations extending over 25,000 kilometers proved that motor traction is suited to certain conditions of traffic. The État ordered

10 cars, substituting an 85-horsepower engine for one of 60 horsepower employed in previous trials. These motors have been in operation since the beginning of 1925, and have covered almost 120,000 kilometers with no accidents other than minor breakdowns.

The equipment weighs 15 tons in running order. There is space for two tons of baggage and two second-class compartments for passengers. The engine can draw two 10-ton cars on easy grades, and one over steep ascents. The passenger capacity of each car is 50. The normal speed of trains is 50 kilometers an hour, the engine alone being able to reach 72 kilometers.

The degree to which this equipment may prove economical, as compared with steam equipment, is not yet fully proved, since the cars have not been in operation long enough to make possible a full estimate of upkeep and deterioration. The operation of the motor trains, it is estimated, costs about 2 francs per kilometer traveled, while the similar cost for steam locomotives is 5 francs.

New equipment installed

Class I railroads during 1925 installed in service 128,557 freight cars, according to reports filed by the carriers with the Car Service Division of the American Railway Association. This was a decrease of 27,857 cars under the number installed in 1924 and a decrease of 69,318 cars under the number installed in 1923. Of the total 61,140 were box cars, 48,670 were coal cars and 5,761 were refrigerator cars.

Freight cars installed in service during the month of December totaled 4,620, which included 1,520 box cars, 2,259 coal cars and 255 refrigerator cars.

Freight cars on order on January 1 totaled 40,794, including 21,380 box cars, 15,368 coal cars and 1,781 refrigerator cars. On January 1, 1925, Class I railroads had 55,684 freight cars on order and on January 1, 1924, they had 25,619 on order.

During 1925, Class I railroads placed in service 1,733 locomotives, as compared with 2,246 during 1924 and 4,037 in 1923. The same roads on January 1, 1926, had 471 locomotives on order as compared with 287 on January 1, 1925, and 510 on the same date in 1924. During December, 1925, 129 locomotives were installed in service.

These figures as to freight cars and locomotives include new, rebuilt and leased equipment.

Wage statistics for November

Class I railroads reported a total of 1,788,889 employees in November, 1925, a decrease of 28,149 or 1.5 per cent as compared with the returns for the previous month, according to the Interstate Commerce Commission's monthly compilation of wage statistics. Seasonal reduction in the maintenance of way forces was the principal cause of this drop in employment. The total compensation shows a decrease of $15,484,696 or 6.0 per cent, due to the reduction in the number of employees coupled with the fact that November had only 24 working days while October had 27. It is noted that the number of employees reported for the month of November, 1925, is almost exactly the same as that reported for the same month in 1924, but, owing to an increase in the number of hours worked per employee, together with an increase in the straight time hourly earnings of 0.6 cents, the total compensation shows an increase of 2.7 per cent.

The number of employees at the middle of the month was as follows:

Group	Nov., 1925	Increase over Oct., 1925	Increase over Nov., 1924
Executives, officials, and staff assistants	16,657	72	330
Professional, clerical, and general	283,892	915	1,958
Maintenance of way and structures	395,301	(d)30,346	6,009
Maintenance of equipment and stores	521,537	1,565	(d)18,678
Transportation (other than train engines, and yard)	210,886	(d)1,015	1,770
Transportation (yardmasters, etc.)	24,143	136	(d)230
Transportation (train and engine service)	336,473	524	9,007
Total	1,788,889	(d)28,149	166

(d) Decrease.

B. & O. applies piston valve cylinders to Mallets

For a number of years the Baltimore & Ohio has been experiencing trouble from cracks developing in the front and back, and extending through the port walls of the slide valve type low pressure cylinders used on some of its Mallet locomotives. In order to eliminate this trouble as well as to increase the efficiency of the low pressure engine, piston valve cylinders have been applied. According to the February, 1926, issue of the Baltimore & Ohio magazine, up to the present time there have been 22 applications of piston valve cylinders made in the Cumberland, Md., locomotive shops. At the beginning of the application of the new type cylinders, a schedule was established to change the Mallet locomotives beginning with two in January, 1925, four in February and six in March. This schedule, however, was increased to eight per month, contingent upon sufficient cylinders being furnished.

The results obtained by this change have been a noticeable decrease in maintenance and a decrease in back pressure. The new application has also practically eliminated all steam leaks and has helped to cut down the fuel consumption. The tonnage has been increased to the extent of one car per train out of Grafton, W. Va., and the time of the run on which these Mallet locomotives have been used has been decreased from between 30 min. to one hr.

Interpretations on Interchange Rules 30, 60 and 101 are issued

The Arbitration Committee has issued the following interpretations of Rules 30 and 60 to eliminate taking of joint evidence on trivial deviations in stencil markings, which are retroactive to cover unsettled conditions.

Rule 30. Question:—It is common practice to stencil new light weight marks a few inches directly above or below the line of previous marks, to avoid delay in restenciling car account wet paint over old marks.

It is also the practice to substitute 3-in. stenciling for 4-in. stenciling where the letter is the standard for the car, as well as 4-in. stenciling where 3-in. stenciling is standard.

Do these deviations constitute wrong repairs?

Answer:—The new light-weight markings, as to location and size, should conform to the standard of the car; however, the conditions above described are not such to justify claim of wrong repairs.

Rule 60. Question:—Some roads are using 1¼-in. stencils, others 1½-in., for air brake marking, while the rule specifies 1-in. height. Should such marking be accepted?

Answer:—The question of increasing the size of air brake stenciling is under consideration. It is suggested that a minimum of 1-in. and a maximum of 1½-in. be accepted as meeting present requirements.

Rule 101. Effective January 1, 1926, upon recommendation from the Committee on Brakes and Brake Equipment, the Arbitration Committee has modified Item 22A of this rule to read as follows:

"Cylinder piston packing, Wabco, Flextite, Kendall or J. M. type...."

Attention is also directed to the following error in printing the 1925 Code of the Rules of Interchange, effective January 1, 1926:

Page 134, Rule 101, Item 194A, Note following—Service metal limit quoted in this note should read 35/16-in. instead of 3-5/16-in.

Standardization of chasers for self-opening die heads

Recommendations which will mean a reduction of 75 per cent in the sizes and varieties for chasers for self-opening die heads used in automatic screw cutting machinery were adopted by a general conference of manufacturers, distributors and users, held under the auspices of the Division of Simplified Practice, Department of Commerce, Washington.

This product, the manufactured value of which amounts to some $5,000,000 annually, is used to a considerable extent in the building and maintenance of cars and locomotives. The program adopted by the conference is estimated to hold a potential saving of $500,000 a year in manufacture and distribution, and a large indirect saving to every user of machine screws.

The simplification was in line with work done by the National Screw Thread Commission and the American Engineering Standards Committee, and is a step toward further standardizations in the field of mechanics, as well as helping to bring about a more general use of the accomplishments by the National Screw Thread Commission.

After discussions of the program by members of the Screw

Thread Commission, the American Railway Association, the American Electric Railway Association, the American Society of Mechanical Engineers, and others, the recommendations were adopted, to become effective April 1, 1926, and to be in effect for a year. A standing committee, comprising representatives of the manufacturers, the machine tool builders, mill supply dealers, and large consuming groups will be named to observe the application of the simplifications, to receive suggestions and to develop, if possible, further eliminations.

Meetings and Conventions

New York Railroad Club has unique program

The members of the New York Railroad Club were entertained at the monthly meeting on Friday, February 19, by the Baltimore & Ohio Glee Club. The program, which was given in the auditorium of the Engineering Societies Building, was received with great enthusiasm. The technical part of the meeting was somewhat unusual. A lively open forum discussion was held on constructive suggestions for improving the program and making the work of the club more effective. It was opened by the chairman of the Subjects Committee, Roy V. Wright, editor of the *Railway Mechanical Engineer*.

Chicago section A. S. M. E. to hold railway night

The regular monthly meeting of the American Society of Mechanical Engineers, Chicago Section, held Wednesday evening, February 24, at the rooms of the Western Society Engineers, Monadnock Block, Chicago, was devoted to Railway Night, the subject for discussion being the three-cylinder locomotive. "Construction and Economy" features were presented by J. G. Blunt, mechanical engineer, American Locomotive Company; "Operation" by W. A. Pownall, mechanical engineer, Wabash; and "Some Test Results" by E. L. Woodward, western editor of the *Railway Mechanical Engineer*.

Association for railway women organized in Chicago

The Railway Business Women's Association, Chicago, has been organized by women employed by railroads, steamship companies, affiliated committees and the Pullman Company, for the purpose of advancing social, business and intellectual development. Membership is open to all women employed in transportation service. The organization is divided into divisions according to the various railroads, steamship lines and committees, 13 divisions having been organized so far. The association is similar to one already established in the Twin Cities, composed of approximately 1,000 members.

Officers of the association are, president, Miss Cora Nelson, associated with the Western Trunk Line Committee; first vice-president, Miss Nancy C. McKinley, secretary to the freight traffic manager of the Chicago, Rock Island & Pacific; second vice-president, Miss L. J. Noelle, of the Western Trunk Line Committee; third vice-president, Miss D. Oden, who is in charge of women on the Chicago, Burlington & Quincy; recording secretary, Miss H. Smith, of the Central Freight Association; corresponding secretary, Miss I. Gates, Chicago & North Western; financial secretary, Miss L. Kennedy, New York Central; and treasurer, Mrs. W. G. Brown, Baltimore & Ohio.

Lehigh Valley Shop Crafts Association dinner

The Association of Maintenance of Equipment Employees and the Shop Crafts Athletic Association at the system shops of the Lehigh Valley at Sayre, Pa., held their first annual dinner in the Assembly Hall at the shops on Thursday, February 18. There were over 1,100 shop crafts employees and their ladies present. Music was furnished by the Sayre System Shop Band. Harry Farr, piecework inspector, officiated as toastmaster. Two of the younger men who attended the Younger Railroad Men's Conference at Pittsburgh last November, told of what it had meant to them and gave encouraging messages to the apprentices and younger men who attended the dinner. The young men who spoke were Leo Downs, machinist apprentice, and Donald Green, electrician apprentice. Alexander C. Birney, chairman of the blacksmiths, commented on the remarkable spirit of co-operation which existed between the shop crafts employees and the management on the Lehigh Valley. Roy V. Wright, editor of the *Railway Mechanical Engineer*, discussed some of the fundamental principles upon which co-operation and teamwork are based.

The following list gives names of secretaries, dates of next or regular meetings and places of meeting of mechanical associations and railroad clubs.

Air-Brake Association.—F. M. Nellis, Room 3014, 165 Broadway, New York City. Next convention May 4 to 7 inclusive, Hotel Roosevelt, New Orleans, La.

American Railroad Master Tinners', Coppersmiths' and Pipefitters' Association.—C. Borcherdt, 202 North Hamlin Ave., Chicago.

American Railway Association, Division V.—Mechanical.—V. R. Hawthorne, 431 South Dearborn St., Chicago. Next meeting June 9-16, inclusive, Young's Million Dollar Pier, Atlantic City, N. J.

Division V.—Equipment Painting Section.—V. R. Hawthorne, Chicago. Next meeting September 21-23.

Division VI.—Purchases and Stores.—W. J. Farrell, 30 Vesey St., New York. Next meeting, June 9, 10 and 11, in the Vernon Room of the Haddon Hall Hotel in Atlantic City.

American Railway Tool Foremen's Association.—G. G. Macina, 11402 Calumet Ave., Chicago. Annual convention September 1-3, Hotel Sherman. Chicago.

American Society of Mechanical Engineers.—Calvin W. Rice, 29 W. Thirty-ninth St., New York. Railroad Division, Marion B. Richardson, 30 Church St., New York.

American Society for Steel Treating.—W. H. Eiseman, 4600 Prospect Ave., Cleveland, Ohio.

American Society for Testing Materials.—C. L. Warwick, 1315 Spruce St., Philadelphia, Pa. Annual meeting June 21-25, Atlantic City.

Association of Railway Electrical Engineers.—Joseph A. Andreucetti, C. & N. W., Room 411, C. & N. W. Station, Chicago, Ill.

Canadian Railway Club.—C. R. Crook, 129 Charron St., Montreal, Que. Regular meetings second Tuesday in each month, except June, July and August, at Windsor Hotel, Montreal, Que. Next meeting March 9. A paper on the oil-electric locomotive in railroad service by L. G. Coleman, manager, Locomotive Department, Ingersoll-Rand Company, New York. Illustrated by lantern slides.

Car Foremen's Association of Chicago.—Aaron Kline, 626 N. Pine Ave., Chicago, Ill. Meeting second Monday in month, except June, July and August, Great Northern Hotel, Chicago, Ill.

Car Foremen's Association of St. Louis.—R. E. Giger, 721 North 23rd St., E. St. Louis, Ill. Meetings, first Tuesday in month, except June, July and August, at the American Hotel Annex, St. Louis.

Car Foremen's Club of Los Angeles.—J. W. Krause, 514 East Eighth St., Los Angeles, Cal. Meeting second Friday of each month in the Pacific Electric Club Building, Los Angeles, Cal.

Central Railway Club.—H. D. Vought, 26 Cortlandt St., New York, N. Y. Regular meetings, second Thursday each month, except June, July and August. Hotel Statler, Buffalo, N. Y.

Chief Interchange Car Inspectors' and Car Foremen's Association.—A. S. Sternberg, Belt Railway, Clearing Station, Chicago.

Cincinnati Railway Club.—W. C. Cooder, Union Central Building, Cincinnati, Ohio. Meetings, second Tuesday, February, May, September and November.

Cleveland Steam Railway Club.—F. L. Frericks, 14416 Adler Ave., Cleveland, Ohio. Meetings first Monday each month except July, August and September, at Hotel Hollenden, East Sixth and Superior Ave., Cleveland, Ohio. Next meeting March 1. The following papers will be presented: Further discussion of A.R.A. Rules; Discussion of Supplement No. 1 to the A.R.A. Loading Rules; The recommended changes to be presented before the A.R.A. Association in connection with A.R.A. Rules.

International Railroad Master Blacksmiths' Association.—W. J. Mayer, Michigan Central, 2347 Clark Ave., Detroit, Mich. Next convention August 17-19, Hotel Winton, Cleveland, Ohio.

International Railway Fuel Association.—J. B. Hutchison, 1809 Capitol Ave., Omaha, Neb. Next meeting May 11-14, 1926, Hotel Sherman, Chicago.

International Railway General Foremen's Association.—William Hall, 1061 W. Wabash Ave., Winona, Minn.

Master Boilermakers' Association.—Harry D. Vought, 26 Cortlandt St., New York. Next meeting May 25-28, 1926, Hotel Statler, Buffalo, N. Y.

New England Railroad Club.—W. E. Cade, Jr., 683 Atlantic Ave., Boston, Mass. Regular meeting second Tuesday in month, except June, July, August and September. Copley-Plaza Hotel, Boston, Mass. Next meeting March 9. A paper on the annual meeting election of officers and a moving picture on steel will be presented by George A. Richardson, publicity manager, Bethlehem Steel Company.

New York Railroad Club.—H. D. Vought, 26 Cortlandt St., New York. Meeting third Friday in each month, except June, July and August, at 29 West Thirty-ninth St., New York.

Niagara Frontier Car Men's Association.—George A. J. Hochgreb, 625 Brisbane Building, Buffalo, N. Y. Regular meetings, January, March, May, September and October.

Pacific Railway Club.—W. S. Wollner, 64 Pine St., San Francisco, Cal. Regular meetings, second Thursday of each month in San Francisco and Oakland, Cal., alternately. Next meeting, March 11, at Fairmont Hotel, San Francisco, Cal. Reception and banquet to R. H. Ashton, president, American Railway Association.

Railway Club of Greenville.—F. D. Castor, clerk, maintenance of way department, Bessemer & Lake Erie, Greenville, Pa. Meeting last Friday of each month, except June, July and August.

Railway Club of Pittsburgh.—J. D. Conway, 515 Grandview Ave., Pittsburgh, Pa. Regular meeting fourth Thursday in month, except June, July and August. Fort Pitt Hotel, Pittsburgh, Pa.

St. Louis Railway Club.—B. W. Frauenthal, Union Station, St. Louis, Mo. Regular meetings, second Friday in each month, except June, July and August.

Southeastern Carmen's Interchange Association.—J. E. Rubley, Southern Railway shops, Atlanta, Ga.

Texas Car Foremen's Association.—A. I. Parish, 106 West Front St., Fort Worth, Tex. Regular meetings, first Tuesday in each month, Terminal Hotel Bldg., Fort Worth, Texas.

Traveling Engineers' Association.—W. O. Thompson, 1177 East Ninety-eighth St., Cleveland, Ohio. Annual meeting September 14-17, Hotel Sherman, Chicago.

Western Railway Club.—Bruce V. Crandall, 226 W. Jackson Blvd., Chicago. Regular meetings, third Monday in each month, except June, July and August.

Supply Trade Notes

G. L. Hulben has been added to the sales force of the Chicago branch of the Ludlum Steel Company, Watervliet, N. Y.

Roy M. Chisson has been appointed manager of railway sales of the Otley Paint Manufacturing Company, Chicago, Ill.

Harry Loeb, of the Philadelphia sales office of the Lukens Steel Company, Coatesville, Pa., has been transferred to the New York office.

J. Howard Horn, sales manager of the National Lock Washer Company, has been elected general sales manager, with headquarters at Newark.

James H. Enochs, representative of the Harnischfeger Sales Corporation, Milwaukee, Wis., has been appointed manager of the new branch established at Indianapolis, Ind.

The Ohio Injector Company, Wadsworth, Ohio, has established a branch office at 30 National building, Cleveland, Ohio, and has appointed F. L. Dalzell district sales manager.

The Sidney B. Roby Company, 203 South avenue, Rochester, N. Y., will in future represent exclusively in Monroe county, N. Y., The Geometric Tool Company, New Haven, Conn.

Braeburn Alloy Steel Corporation announce the new location of their Pittsburgh district sales office at First National Bank building, Pittsburgh, Pa. L. M. Brown is district manager.

E. T. McCleary, assistant vice-president in charge of operation of the Youngstown Sheet & Tube Company, Youngstown, Ohio, has been promoted to vice-president in charge of operations.

A. R. Pinney has joined the sales force of the Bonney Forge & Tool Works, Allentown, Pa., manufacturers of chrome vanadium wrenches. He has been assigned territory including Pennsylvania, New Jersey and Maryland.

W. G. Willcoxson, formerly representative of Milar Clinch & Co., Chicago, has been appointed representative of the Boss Bolt and Nut Works division of the Hoopes & Townsend Corporation, with headquarters in Chicago.

Herman Steinkraus now represents the Bridgeport Brass Company, Bridgeport, Conn., in the Cleveland, Ohio, territory. Mr. Steinkraus has charge of the Bridgeport Brass Company's Cleveland warehouse service as well as sales.

Fred A. Fenton, who formerly represented Joseph T. Ryerson & Son, Inc., New York, covering railroads and industrials on machine tools, has opened an office at 30 Church street, room 423, New York City, as a representative of manufacturers.

P. E. Krider, district manager of S. F. Bowser & Co., Inc., Ft. Wayne, Ind., with headquarters at Chicago, has been promoted to manager of railway sales to succeed E. M. Harshbarger, who has been appointed district manager, with headquarters at New York.

The Erie Foundry Company, Erie, Pa., has opened the following district sales offices: At 1120 Myrtle avenue, Plainfield, N. J., in charge of H. Terhune; 549 Washington boulevard, Chicago, in charge of L. F. Carlton, and 408 Donovan building, Detroit, Mich., in charge of R. B. McDonald.

Bard Browne has been appointed assistant to the vice-president in charge of sales and service of The Superheater Company, 17 East Forty-second street, New York. Mr. Browne came with the company in 1914, and has been actively identified in the application of locomotive superheaters and feedwater heating devices, serving in various engineering sales and service capacities.

The Chicago Steel Car Company, Harvey, Ill., has changed its name to the Gibson Car & Manufacturing Company. R. A. Pascoe, secretary of the Whiting Corporation, has also been appointed secretary-treasurer of the Gibson Car & Manufacturing Company, and T. S. Hammond, president of the Whiting Corporation, has been appointed vice-president of the Gibson Car & Manufacturing Company.

The stockholders of the Pressed Steel Car Company have approved the plan for the merger into that company of the Western Steel Car & Foundry Company, all the stock of which was owned by the parent company. The stockholders also approved a change in the capital structure, calling for the establishment of cumulative preferred stock. F. N. Hoffstot, president of the Pressed Steel Car Company, stated that the Skelly interests had acquired a large holding in the Pressed Steel Car Company and that J. S. Skelly had been elected a director, succeeding George H. Russell, resigned.

The Virginia Equipment Company, makers of Virginia dust guards for the railroad industry, and the Michigan Head Lining Company, makers of cooperage products, which have for several years been operated as separate companies under the same ownership and management, have been consolidated into one corporation to be known as the Lacey Williams Company, with general office in the Hanna building, Cleveland, Ohio.

Godwin Shenton, formerly assistant to the president and manager of the Coplan Steel Corporation, Ogdensburg, N. Y., is now associated with The Q and C Company in the mechanical staff and will specialize and co-operate with the Ohio Steel Foundry Co., of Springfield and Lima, Ohio, in the manufacture and sale of locomotive grate bars made of special heat enduring steel. Mr. Shenton's headquarters will be at 90 West street, New York City.

LeGrand Parish has retired as president of the American Arch Company, New York, and has been succeeded by H. B. Slaybaugh, who has been executive vice-president of the company and has been associated with Mr. Parish throughout the life of the company. George A. Price, treasurer, has been made secretary and treasurer; F. B. Johnson has been made assistant secretary, and H. W. Muller has been made assistant treasurer, all with headquarters at New York.

M. A. Herald has resigned as sales representative of the Standard Tank Car Company, Sharon, Pa., and has organized The United Car & Equipment Company, with offices in the Westinghouse building, Pittsburgh, Pa. In addition to operating The United Tank Line, The United Car & Equipment Company will be the representative of the Union Draft Gear Company, the Universal Draft Gear Attachment Company and other manufacturers, dealing in new and second-hand railroad cars and equipment.

The Dreses Machine Tool Company, Cincinnati, Ohio, has given a contract for an entirely new plant to cost $100,000. The Austin Company, Cleveland, is the engineer and builder. The new plant will be of one-story design, 90 ft. by 300 ft, with monitor. About 100 tons of structural steel will be required. Cranes will be installed, two 5-ton cranes in the center aisle and one 3-ton crane in the side aisle. The Austin Company contract includes heating, lighting, plumbing and erection of cranes in addition to construction.

The Northwestern Motor Company, Eau Claire, Wis., has appointed the following representatives: W. Newton Jeffress, Inc., Washington, D. C.; Shaffner & Allen, New York; Otis B. Duncan, Chicago; A. A. Culp, Birmingham, Ala.; William J. Roehl, St. Louis, Mo.; Rank & Goodell, St. Paul, Minn.; the W. H. Worden Company, San Francisco, Cal; the Western Railway Supply Company, Portland, Ore., and the Koppel Industrial Car & Equipment Company, Koppel, Pa. W. Newton Jeffress, of the Washington office, has been appointed manager of sales for the Eastern region.

Plans for the reorganization of the North American Car Company, Chicago, as the North American Car Company of Illinois were approved at a stockholders' meeting on January 22. The new organization will have a capitalization of 125,000 shares of common stock, of which 83,500 will be issued. The purpose of the financing is to provide the company with additional capital to meet the needs of an expanding business. The plan calls for the exchange of the class A stock of the present corporation for the common stock of the new concern on a share-for-share basis, and of the present common stock on a two-for-one basis.

At a meeting of the board of directors of the J. G. Brill Company on January 29, W. H. Woodin, president of the American Car & Foundry Company, was elected a director to fill the unexpired term of William H. Heulings, Jr., deceased. At the

organization meeting of the Brill Corporation, a Delaware corporation, held in New York City, on January 30, the following directors were elected: Samuel M. Curwen, William M. Hager, Francis A. Lewis, William Clarke Mason, E. P. Rawle, C. S. Sale, G. R. Scanland and W. H. Woodin, and the directors elected the following officers: W. H. Woodin, chairman of the board; Samuel M. Curwen, president; G. R. Scanland, vice-president; H. C. Wick, secretary, and S. A. Mallette, treasurer.

The interests of the Columbia Steel Company, Elyria, Ohio, and the Forged Steel Wheel Company, Pittsburgh, Pa., have been combined. Sufficient finishing equipment to assure control over every operation entering into the production of hot and cold rolled strip steel will be installed. The Columbia Steel Company started operation in 1898 and for years manufactured high grade cold rolled strip steel. The manufacture of forged steel wheels, for railroad equipment, the principal product of the Forged Steel Wheel Company, will be continued at the Butler plant, and the manufacture and selling of this product will be handled by the same organization as in the past. The plant of the Forged Steel Wheel Company was first operated in 1912. The products consisted of forged wheels, billets, slabs, plates and bars.

The American Car & Foundry Company has formed the American Car & Foundry Motors Company, which was incorporated in Delaware, on December 23. The new company will own a controlling interest in the Fageol Motors Company of Ohio, manufacturers of motor buses and trucks, and in the Hall-Scott Motor Car Company of Oakland, Cal., manufacturer of gasoline engines for motor trucks, airplanes and motor boats and the new company in turn will be controlled by the American Car & Foundry Company. This is the first important entry by a railroad equipment company into the automotive field and the formation of this company is in line with the trend toward new forms of locomotion in the railroad field. The new company was organized to develop the business in gasoline railway equipment and will manufacture trucks for railroad companies.

The Coach & Car Equipment Corporation, Railway Exchange building, Chicago, has been organized to handle seating material and seating equipment for steam and electric railways and motor coaches by Edward Buker, formerly manager of railroad sales of the Heywood-Wakefield Company, with headquarters at Chicago. Mr. Buker graduated from the University of Illinois in 1908 and for the following three years was a car apprentice for the Pullman Company. For the following two years he was a special boiler maker apprentice on the Illinois Central and was later promoted to inspector, with headquarters at Chicago. In 1915 he was appointed general foreman on the Minnesota division of the Chicago, Rock Island & Pacific, and in 1916 was appointed master mechanic of the Missouri-Kansas-Texas, with headquarters at Dallas, Tex. In 1919 he entered the employ of the Galena Signal Oil Company as a mechanical expert and salesman and a year later was appointed western sales manager of the Rome Iron Works. In 1920 he became manager of railroad sales of the Heywood-Wakefield Company, with headquarters at Chicago.

E. Buker

Clinton L. Bardo, formerly general manager of the New York, New Haven & Hartford, who resigned in June, 1925, has been elected vice-president of American Brown, Boveri Electric Corporation, with headquarters at 165 Broadway, New York City, a subsidiary of Brown, Boveri & Co., Ltd., Baden, Switzerland, electrical manufacturers, who early this year announced that they would enter the American market. The new company has bought the plant of the New York Shipbuilding Corporation at Camden, N. J., and will make this its manufacturing center for the building of turbines, electric locomotives and large electrical apparatus. In addition, the company has manufacturing facilities at Hyde Park, Boston, Mass., and at Sidney, N. Y. Mr. Bardo, who will have his headquarters at New York, is on a tour abroad, inspecting the plants of the associated companies.

R. M. Thomas and Donald Charlton have been appointed technical representatives of the Reading Iron Company, Reading, Pa. The technical department, which they head, is a newly created service division in the sales department. R. M. Thomas for the past four years has been associated with the Chicago office of the Reading Iron Company. He received his technical training at Cornell University and Carnegie Institute of Technology, and is a member of the American Institute of Mining and Metallurgical Engineers and the Western Society of Engineers. Mr. Thomas will represent the Reading Iron Company in offices of various railroad systems of the West. His headquarters will be at 449 Conway building, Chicago, Ill. Donald Charlton has been for the past six years in the manufacturing division of the Reading Iron Company, the last two and one-half years of which he served in the capacity of assistant engineer of tests. Mr. Charlton will call on eastern railroads and will have his headquarters in the general office of the Reading Iron Company, Reading, Pa.

Henry M. Norris, secretary and a director of the Cincinnati Bickford Tool Company, died suddenly of heart disease on December 24, at Cincinnati, Ohio. Mr. Norris was born in Trenton, N. J., January 21, 1868. He received his earlier education in the Trenton schools and began his mechanical career as an apprentice in Bement, Niles & Company's shops. He entered the Sibley College of Cornell University as a special student in mechanical engineering and then went to the Ferracute Machine Company as draftsman. Later he was employed by the Brown & Sharpe Manufacturing Company and the Pond Machine Tool Company. From 1894 to 1895 he was superintendent and engineer for the Appleton Manufacturing Company and the Riehle Brothers Testing Machine Company. He was general manager of the Campbell & Zell Company. In 1897 he became works manager of the Bickford Drill & Tool Company, continuing in this capacity until the formation of the Cincinnati-Bickford Tool Company in 1909, when he became secretary and a director of the new organization. Mr. Norris was an inventor in the machine tool field, and his work was especially identified with the development of the modern type of high speed lathe and radial drill. He also wrote a number of treatises on machine tool subjects. In 1892 Mr. Norris joined the American Society of Mechanical Engineers. He was chairman of the Cincinnati section of the society in 1920 and a manager of the council of the society from 1920 to 1923.

Henry M. Norris

Following the co-ordination of the engineering, manufacturing and sales departments, as it relates specifically to the steam power equipment manufactured by the Westinghouse Electric & Manufacturing Company, at the South Philadelphia and Attica works, H. T. Herr, resident vice-president in charge of these activities, announces the following appointments: Howell Van Blarcom has been appointed manager of the sales department with R. E. Carothers as assistant manager. The large turbine sales section of the South Philadelphia works will be conducted with A. H. Ganshird as manager. This section will handle all matters pertaining to straight reaction and combination turbine and turbo-generator units for land and marine service. The small turbine section will be in charge of C. G. Ong, while P. L. Fetzer will be manager of the condenser section.

Personal Mention

General

G. W. GILLELAND has been appointed superintendent of motive power of the Central and Southern districts, with headquarters at Jacksonville, Fla., succeeding Mr. Hanlin.

R. B. WHITE, former general manager of the Baltimore & Ohio, New York Terminals, has been elected senior vice-president of the Central Railroad of New Jersey, with headquarters at New York.

J. J. HANLIN, superintendent of motive power of the Seaboard Air Line, has had his jurisdiction extended to include the Southern district, and has also been appointed superintendent of motive power of the Charlotte Harbor & Northern, with headquarters at Jacksonville, Fla.

The appointment of P. W. KIEFER as chief engineer of motive power and rolling stock of the New York Central was announced in the February *Railway Mechanical Engineer*. His jurisdiction includes all the New York Central Lines and not the New York Central Railroad only, as might have been inferred from the announcement.

EDWIN P. MOSES has been appointed engineer of rolling stock of the New York Central Lines, with headquarters at New York. He entered railway service on June 1, 1905, with the New York Central & Hudson River as a draftsman (locomotive and car), and on July 1, 1909, became leading car draftsman. He became chief car draftsman on February 15, 1911, and general car inspector on September 1, 1918. From March 16, 1921, to September 15, 1921, he was foreman construction inspector, and from the latter date to March 16, 1923, was general inspector. He became chief equipment inspector on March 16, 1923, assistant engineer of rolling stock on May 1, 1924, and general equipment inspector of rolling stock on January 1, 1925, which position he was holding at the time of his recent appointment.

F. H. HARDIN, who has been promoted to assistant to the president of the New York Central Lines, was born on June 14, 1886, at Gainesville, Ga., and was graduated from the Georgia School of Technology in 1908, and from Columbia University in 1909. He entered railway service on August 1, 1909, and until August, 1911, was a special apprentice on the New York Central & Hudson River (now a part of the New York Central), at West Albany, N. Y., and from August, 1911, to March, 1912, was construction inspector. At that time he became assistant enginehouse foreman, which position he held until October, 1913, when he became assistant general foreman at Utica. From November, 1914, until March, 1917, he was a special engineer in the office of the assistant to the president, and from that date until November, 1918, was master mechanic on the Adirondack division. He became assistant to the federal manager in November, 1918, and in March, 1920, chief engineer of motive power and rolling stock, which position he was holding at the time of his recent promotion to assistant to the president.

F. H. Hardin

A. A. RAYMOND has been appointed superintendent of fuel and locomotive performance of the New York Central, with headquarters at Utica, N. Y. He was born on November 11, 1886, at Troy, N. Y., and was graduated from Cornell University in 1910, with the degree of M. E. He entered railroad service on July 15, 1910, with the New York Central as a special apprentice at the Avis shops, and on November 16, 1912, was appointed assistant enginehouse foreman. On January 17, 1917, he became service test engineer at New York, N. Y., and on July 16, 1920, he was appointed assistant master mechanic, with headquarters at Syracuse, N. Y. Mr. Raymond served in the same capacity at Buffalo, N. Y., from November 1, 1922, until June 16, 1924, when he became master mechanic at Watertown, N. Y., which position he held until his recent appointment as superintendent of fuel and locomotive performance.

CHARLES E. BARBA has been appointed mechanical engineer of the Boston & Maine, with headquarters at North Station, Boston. Mr. Barba was born on May 12, 1877, in Freemansburg, Pa., and was graduated from Lehigh University in 1901. From July, 1901, to July, 1902, he was a draftsman in the Ordnance Department at Washington, D. C. He entered the service of the Pennsylvania in July, 1922, in the motive power department at Altoona, and until February, 1915, was consecutively draftsman, assistant chief draftsman and assistant engineer. He resigned in 1915 to join the Midvale Steel Company at Philadelphia. He was with this company from February, 1915, to November, 1917, first in the production office, then as foreman, and later as superintendent of a machine shop. He left this company in 1917, to take up war-time work at the Watertown Arsenal, and from 1917 to 1922 he served successively as superintendent of the mobile carriage shop and superintendent of the sea coast department of the arsenal. In 1922 Mr. Barba became superintendent of the Osgood-Bradley Car Company at Worcester, Mass., which position he was holding at the time of his appointment as mechanical engineer of the Boston & Maine.

Master Mechanics and Road Foremen

F. S. MARKETT has been appointed master mechanic of the Charlotte Harbor & Northern, with headquarters at Arcadia, Fla.

H. C. QUARLES has been appointed master mechanic of the West Florida division of the Seaboard Air Line with headquarters at St. Petersburg, Fla.

G. A. HASLETT has been appointed general road foreman of engines of the Central and of the Seaboard Air Line, with headquarters at Tampa, Fla.

L. E. CREVASSE has been appointed master mechanic of the East Florida division of the Seaboard Air Line, with headquarters at West Palm Beach, Fla.

E. R. HANNA has been appointed master mechanic of the Central Kansas division of the Missouri Pacific, with headquarters at Asawatomie, Kan., succeeding W. P. Kershner, resigned.

W. D. FREEMAN has been appointed master mechanic of the North Carolina division of the Seaboard Air Line, with headquarters at Hamlet, N. C., succeeding T. J. Raycroft, resigned.

M. R. BENSON has been appointed division master mechanic of the Michigan Central, with headquarters at St. Thomas, Ont., succeeding E. R. Webb, relieved at his own request on account of health.

THOMAS E. CANNON, general master mechanic of the Great Northern, with headquarters at Superior, Wis., has been appointed general superintendent of locomotives and equipment of the Pittsburgh & West Virginia, with headquarters at Pittsburgh, Pa. He was born on April 23, 1856, at New York, N. Y., and was educated in the public schools at New York. He entered railway service in 1871, with the St. Paul & Pacific, afterwards the St. Paul, Minneapolis & Manitoba, and now the Great Northern, and until October 3, 1875, was a machinist's apprentice. From October 3, 1875, to April 6, 1878, he was a fireman, and from the latter date until December 1895, was a locomotive engineman. At that time he became master mechanic, and later became general master mechanic, of the Lake district, which position he was holding at the time of his recent appointment as general superintendent of locomotives and equipment of the Pittsburgh & West Virginia.

Shop and Enginehouse

C. W. DAVIS has been appointed night enginehouse foreman of the Kansas City Southern at Shreveport, La.

O. E. WINGER has been appointed assistant enginehouse foreman of the Kansas City Southern at Shreveport, La.

E. W. HESS has been appointed general enginehouse foreman of the Kansas City Southern with headquarters at Heavener, La.

L. C. KIRKHUFF has been appointed general locomotive foreman of the Kansas City Southern with headquarters at Shreveport, La.

E. M. HERCHER, air brake machinist of the St. Louis Southwestern has been promoted to enginehouse foreman, with headquarters at Pine Bluff, Ark.

J. E. POTTER, assistant enginehouse foreman of the St. Louis Southwestern with headquarters at Pine Bluff, Ark., has been promoted to enginehouse foreman succeeding O. E. Cole, resigned.

Purchasing and Stores

L. FROST has been appointed general storekeeper of the Missouri & North Arkansas, with headquarters at Harrison, Ark.

J. W. MORIAETY has been appointed storekeeper of the Charlotte Harbor & Northern, with headquarters at Arcadia, Fla.

T. A. ROUSSEAU has been appointed storekeeper of the Seaboard Air Line with headquarters at Howells, Ga., succeeding Mr. Hodges.

G. H. WALL has been appointed division storekeeper of the Chicago & Alton with headquarters at Slater, Mo., succeeding Mr. Murphy.

A. HENSLER has been appointed assistant storekeeper of the Seaboard Air Line with headquarters at Jacksonville, Fla., succeeding Mr. Rousseau.

W. W. MORRIS, assistant purchasing agent of the Pennsylvania, has been promoted to assistant to the general purchasing agent, Philadelphia, Pa.

FRANK J. MCMAHON, has been promoted to general storekeeper of the New York Central, lines west of Buffalo, with headquarters at Collinwood, Ohio.

T. A. HODGES has been appointed assistant general storekeeper of the Seaboard Air Line and has been temporarily assigned to special duties in connection with building of new lines in Florida.

E. L. MURPHY, division storekeeper of the Chicago & Alton, with headquarters at Slater, Mo., has been promoted to traveling storekeeper, with headquarters at Bloomington, in place of Mr. Wolfe.

E. J. LAMNECK, assistant to the purchasing agent of the Pennsylvania, has been promoted to stationary storekeeper, with headquarters at Pittsburgh, Pa., succeeding A. W. Able, who died recently.

H. O. WOLFE, traveling storekeeper of the Chicago & Alton, with headquarters at Bloomington, has been promoted to assistant general storekeeper, with the same headquarters, a newly created position.

J. H. DAVIS, storekeeper on the Minneapolis & St. Louis with headquarters at Marshalltown, Ia., has been appointed purchasing agent of the Minneapolis, Northfield & Southern, with headquarters at Minneapolis, Minn.

R. C. HARRIS, general storekeeper, of the Pennsylvania, with headquarters at Philadelphia, Pa., has been promoted to assistant stores manager, succeeding G. W. Snyder, who recently became assistant chief engineer in charge of maintenance.

E. C. HOFFMAN, assistant purchasing agent of the Minneapolis & St. Louis, with headquarters at Minneapolis, Minn., has been promoted to purchasing agent, with the same headquarters, and the position of assistant purchasing agent has been abolished.

FRANK RILEY, chief clerk to the general storekeeper of the Chicago & Alton, with headquarters at Bloomington, Ill., has been promoted to general storekeeper, with the same headquarters, succeeding G. A. Secor, who resigned to enter other business.

J. P. MURPHY, general storekeeper of the New York Central, lines west of Buffalo, at Collinwood, Ohio, has been promoted to stores assistant to the manager of purchases and stores of the system, with headquarters at Cleveland, a newly created position.

Obituary

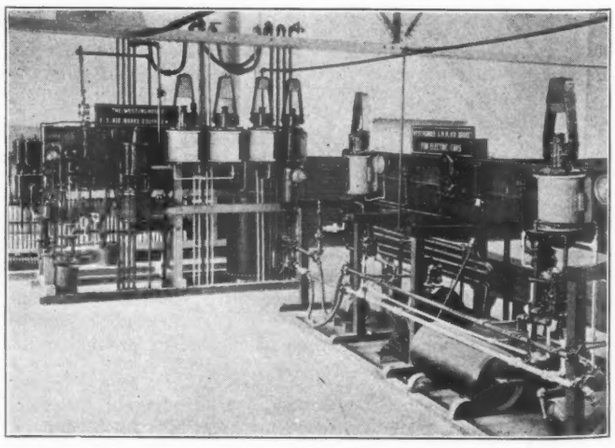
C. W. SCHAEFER, blacksmith shop foreman on the Central of Georgia, Macon, Ga., died on January 29. Mr. Schaefer had been in the service of this road for about 35 years.

ROBERT HOBSON, chairman of the board of the Canadian Locomotive Company, Ltd., Hamilton, Ontario, and president of the Steel Company of Canada, Ltd., died on February 25 at his home in Hamilton at the age of 65. He first began work on the railroads but later became secretary-treasurer of the Hamilton Blast Furnace Company. In 1899 he went to the Hamilton Iron & Steel Company as general manager, and in 1910, was appointed general manager of the Steel Company of Canada, Ltd., becoming president of that company in 1916. He had served also as an officer or a director of a number of financial and industrial organizations.

WIBLE L. MAPOTHER, president of the Louisville & Nashville, died of heart disease at Panama on February 3. Mr. Mapother was born in Louisville, Ky., on September 28, 1872. Upon completing a grade school education he entered the employ of the Louisville & Nashville as an errand boy and file clerk in the office of the secretary. In August, 1889, less than a year after he had started to work, he attracted the attention of Mr. Smith, who was then vice-president and who at once transferred him to the clerical force in the executive department. In May, 1902, he was made chief clerk in the executive offices. His next promotion, on July 16, 1904, made him assistant to the president. On February 16, 1905, he was elected first vice-president.

W. L. Mapother

He was elected a director of the Louisville & Nashville on October 7, 1914. In November, 1915, he also became vice-president of the Lexington & Eastern, which was acquired by the Louisville & Nashville in 1912. During the period of federal control he was appointed federal manager of the Louisville & Nashville and the Louisville, Henderson & St. Louis. His jurisdiction was extended over the Nashville, Chattanooga & St. Louis, and the Tennessee Central, and later, over the Birmingham & Northwestern. On February 28, 1920, when the Louisville & Nashville system was turned back to private control, Mr. Mapother resumed his position as first vice-president and in March, 1921, succeeded Mr. Smith as president. Wible L. Mapother was in the service of the Louisville & Nashville for a continuous period of 38 years, all his business life having been spent with the company.



Westinghouse air brake racks used for instruction in railway mechanical engineering at The Pennsylvania State College